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Aeromycological Spore Loads at a Newly Activated Compost Facility

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AEROMYCOLOGICAL SPORE LOADS AT A NEWLY ACTIVATED COMPOST FACILITY

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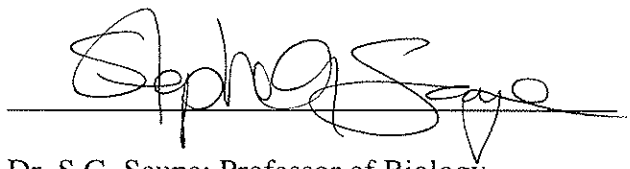

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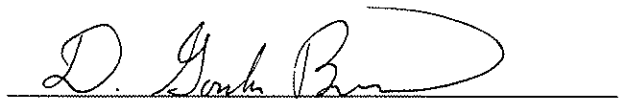

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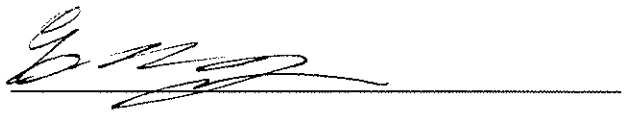

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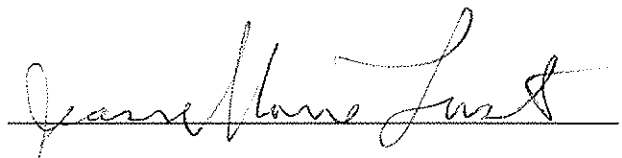

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ABSTRACT- Composting facilities, because of the processes that occur there, may be associated with increased fungal spore loads in the air. We monitored the spore loads present at a newly activated composting facility (Mississippi Topsoils, Inc.; Cold Spring, MN) before and after its activation during October and November of 1999. Petri dishes were arrayed on the downwind side of the compost site and exposed for a range of time periods. The exposed petri dishes were incubated for 48 hours and the number of yeast-like, filamentous, and total fungal colony-forming-units (CFUs) was recorded. The spore load data were also compared to weather data taken from the Minnesota Climatology Working Group's St. Cloud station in order to make connections between climate and spore loads. We found that the total number of CFUs decreased after activation and that there is a direct relationship between temperature/wind speed and magnitude of the spore load. The decrease in CFUs is most likely related to decreasing seasonal temperatures. We were unable to detect an impact of the compost facility on CFU density.

Introduction

AEROBIOLOGY/AEROMYCOLOGY

People have long been fascinated by the invisible particles that travel on the air. The ancient Greek scientists Hippocrates and Lucretius first hypothesized the existence of microscopic particles that floated along wind currents (Gregory, 1973). Since aerobiology's early start, hygienists, allergists, plant pathologists, bacteriologists, mycologists, and an array of other scientists have invested copious amounts of time and money into its study.

Aerobiology was first defined by Fred C. Meier in the early part of the 20th century as being "a far-reaching project of research on microbial life in...air" (Gregory, 1973). The concern of this study, however, is more specific, focusing primarily on airborne fungal spores. Spores are

the basic sexual reproductive unit of fungi and compose approximately 80% of the Earth's airspora (Gregory, 1973).

Fungus spores liberate in two ways: passively and actively (Burnett, 1968). The species that release spores actively are, for the most part, not the focus of this study, since they are not well represented in the atmosphere. This is because actively released spores are usually wet and heavy, and are "shot," at a maximum distance of a few meters, away from the fungal mass. The dung fungus *Pilobolus* is an example of a species that practices active liberation (Burnett, 1968). Fungal species that produce dry and light spores are primarily liberated passively by exposing the spores to the surrounding atmosphere and allowing air currents to detach them (Moore-Landecker, 1972). The fungal species *Aspergillus, Cladosporium,* and *Penicillium* are examples of passive liberators that produce dry spores and are the focus of this study (Burnett, 1968).

Fungal spores liberate in response to a variety of environmental stimuli, four of them being of supreme importance: wind speed, relative humidity, precipitation, and air temperature (Burnett, 1968; Moore-Landecker, 1972). Airborne spore concentrations increase due to an increase in wind speed because the force of the wind makes them detach from conidiophore/sporangiophore more readily (Burnett, 1968). Numerous scientists have detected this trend in their bioaerosols studies (Hirst 1953; Pady 1959; Zoberi 1961; Gregory, 1973).

Different fungi require different amounts of moisture in the air to deteriorate the tissue connecting the spore to the conidiophore/sporangiophore (Burnett, 1968; Moore-Landecker, 1972). Some, like the Fungi Imperfecti, smuts, and rusts, require a low relative humidity to wither the connective tissue before the spore can be directly liberated by wind (Ingold, 1965; Hirst, 1953). For other species, the connective tissue deteriorates only after contacting water (Burnett, 1968). For example, in *Aspergillus*, the middle lamella between the septum and conidium gelatinizes when hydrated (Burnett, 1968). Zoberi (1961) studied wind speed and relative humidity in relation to spore densities and found a direct relationship: as wind speed and/or relative humidity increase, the mean number of spores present in the air increases.

Precipitation, primarily in the form of rainfall, affects rates of spore liberation in fungal species that require water to gelatinize connective tissues located between the spore and conidiophore/sporangiophore (Moore-Landecker, 1972). A common phenomenon is a measurable increase in airborne spore density a day or two after a rain, sometimes up to twice the amount of spores normally present in the air can be detected (Moore-Landecker, 1972; Pady 1957, 1959). Rainfall can also help promote spore germination, mold colonization, mycelial growth, and conidia production (Richards, 1956). However, extended periods of rainfall also decrease the number of spores in the air by washing spores out of the air (Gregory, 1952).

Since temperature is related to the relative humidity of air, it plays a role in airborne spore densities as well (Pady 1956, 1957, 1959; Hirst 1953; Richards 1956). Generally, higher temperatures evaporate more moisture on the surface of the earth and lower altitudes, which decreases the relative humidity and results in a higher rate of spore liberation (Ingold, 1965). A particularly interesting phenomenon occurs at daybreak, when there is a drastic fall in relative humidity with the rise in temperature, which triggers the release of spores in certain species (Meredith, 1962).

Measuring the number of spores within a volume of air has been an activity scientists have been performing for some time (Gregory, 1973). Air sampling got its start with the work of a Frenchman operating in Paris, Pierre Miquel (Gregory, 1973). Miquel was the first to conduct long-term volumetric sampling of the atmosphere in 1883 with an improved Cunningham aeroconiscope (Gregory, 1973). Basically, Miquel strapped a glass collecting tube with a sticky interior to a weather vane – the vane aligned the collecting tube's opening to the wind (Gregory, 1973). By attaching a water-operated pump to the aeroconiscope, Miquel was able achieve a flow rate of 20 L hr^{-1} and increase the number of spores collected 100 fold (Gregory, 1973). He found that the average number of mold spores in Parisian air during the summer was around 30,000 m^{-3} and only about 1,000 m^{-3} in the winter (Gregory, 1973). Miquel was also the first to

observe a regular diurnal periodicity in spore loads as well as to conduct sampling of sea air (Gregory, 1973).

America during the mid-20th century was an aerobiological hotbed (Gregory, 1973). Numerous scientists conducted extensive long-term studies of the atmosphere and sampling technology developed at a rapid pace. Phillip H. Gregory (1973) performed experiments on virtually all aspects of aerobiology and aeromycology, including everything from spore deposition studies, to air sampling technology, to spore and pollen terminal velocities. Gregory published a plethora of studies (1948, 1949, 1951, 1952, 1954, 1957, 1958, 1966, 1968, 1971) as well as the premiere book on bioaerosols in the atmosphere, Microbiology of the Atmosphere (1973).

Merfyn Richards, an English aeromycologist, exposed petri dishes outside at locations around England in 1952 (1956). He found that over 90% of his samples revealed the same species: *Cladosporium, Pullularia, Penicillium, Epicoccum, Botrytis, Alternaria,* Sphaeropsidales, *Aspergillus*, and *Sporotrichum. Cladosporium* was the predominant species represented (Richards 1956).

S.M. Pady conducted long-term quantitative studies of Canadian air over Montreal in 1950 and 1951 (1956). Pady (1956) used airplanes as well as ground stations for sampling and used two kinds of ground-based samplers. He observed over 40,000 colonies of fungi over the two-year period. The results of his study showed that molds like *Cladosporium*, *Penicillium*, *Aspergillus*, and *Alternaria* constituted the vast majority of the airspora, 47.7%, and the number of colony-forming units (CFUs) per plate ranged from 17.7 CFUs ft^{-3} in August to 0.4 CFUs ft^{-3} in February. The highest number of spores observed was 244 CFUs ft^{-3} in July while the fewest number of spores observed was 0.8 CFUs ft^{-3} in December. Between 1956 and 1958, Pady (1957, 1959) surveyed over 113,000 CFUs from 403 days of sampling in Kansas. He utilized ground-based monitoring, sampling independently for spore counts with a Hirst Spore Trap and colony forming units using petri dishes. The Hirst Spore Trap, developed only a few years prior by

English aeromycologist J.M. Hirst, is an automatic volumetric spore trap designed to suck air through an orifice, impacting spores on a microscope slide covered with a sticky substance (Hirst, 1953). *Cladosporium* was the most common fungus he recorded (1957, 1959). The highest daily reading he observed in Kansas was 1363.8 spores ft^{-3} on July 7, 1953, while the lowest daily reading was 4.8 spores ft^{-3} on March 23, 1954 (1957, 1959).

These data prompted Pady to make correlations between spore loads and climatic variations/weather patterns: primarily, the number of CFUs in relation to temperature and precipitation (1956, 1967, 1959). There was a direct relationship detected between temperature and spore load as well as precipitation and spore load (1956, 1957, 1959). He observed that the number of spores peaks during the late summer months and then decreases to very low levels in the winter, only to increase again with the beginning of a new growing season (Pady, 1957; 1959). Precipitation had an acute influence on spore loads (Pady 1959). The summer of 1957 saw 12.13 inches of rainfall while the summer of 1958 saw 23.85 inches –spore loads in 1958 were double what they were in 1957 (Pady, 1959).

Hirst (1953), besides working on sampling technology, studied the relationship between weather and spore loads in 1951, at sites in Harpenden, England. He found that with dry weather, *Cladosporium, Erysiphe, Alternaria*, smuts, and rusts airborne densities increased and that these types were most abundant in the afternoon and least abundant in the morning (Hirst, 1953). Precipitation reduced the number of these types in the air for a few days also (Hirst, 1953). In wet weather, ascomycetes and basidiomycetes appeared, especially after precipitation and at night when dew was abundant (Hirst, 1953).

COMPOSTING

With the spread of environmental pollution and the environmental movement, alternative forms of disposing wastes have become popular and have begun to replace standard municipal waste management techniques (Finstein, 1992; Millner et al., 1994). One such green process is

composting. Composting is a waste elimination process that relies on microbes to break down organic solids (Finstein 1992). The composted material becomes the "food" for numerous microbes, which metabolize the matter through aerobic respiration, creating high temperatures (up to 60 C^{o}), the hallmark of composting (Finstein, 1992). These temperatures, because of the condensed nature of composting piles, remain fairly consistent over time due to the piles being thermally self-insulating (Finstein, 1992; Dix and Webster, 1995).

Bacteria and fungi are responsible for the high temperatures generated by the composting process (Finstein, 1992; Dix and Webster, 1995). After the initial temperature of the compost elevates, microbes and fungi increase in number, metabolically stimulated by the heat (Finstein, 1992). Higher temperatures select for thermotolerant microbes and fungi. *Aspergillus fumigatus*, for example, can flourish in environments reaching 60 degrees Celsius and can competitively exclude mesophilic organisms at temperatures around 45-50 degrees Celsius (Dix and Webster, 1995). Eventually, though, the temperature (usually around 80 degrees Celsius) of a compost heap will inhibit thermally unstable enzymes making the decompositional process counter-productive and hindering breakdown by microbes and fungi (Finstein, 1992). Besides excessive heat there is one other limiting factor to decomposition: gas exchange. Heavy compaction of the pile doesn't allow for waste gases such as CO_2 to escape or useful gases like O_2 to diffuse into metabolically active sites. The piles begin to ferment when this happens, increasing odors significantly (Finstein, 1992). Also, if a pile is too wet, pores for gas exchange to take place are often times sealed, increasing fermentation and decreasing decomposition rates (Dix and Webster, 1995; Finstein, 1992). For this reason, drier piles decompose more quickly.

There are four main composting systems: static pile, turned windrow, in-vessel, and hybrid (Millner et al., 1994). A static pile is simply a pile of various organic solids placed in a manner that allows air to be introduced passively or actively (Millner et al., 1994). A turned windrow differs from a static pile, in that long piles of compost (windrows) are turned over using a front-end loader at regular intervals (Millner et al., 1994). The turning effectively reduces the

size of the pile by increasing aeration and increasing the rate of decomposition (Finstein, 1992). In-vessel composting requires that the waste be encased in a vessel that is able to control factors such as aeration and agitation (Millner et al., 1994). This is often times the most efficient way of composting, capable of producing a product in as little as 6 hours to several weeks since they usually utilize force ventilation methods (Millner et al., 1994). Forced ventilation removes CO_2, heat, and water vapor while increasing oxygen levels. Forced ventilation and mechanical agitation allow for maximal decompositional rates to be achieved (Finstein, 1992). Hybrid operations are simply a combination of the other three systems and are often hybrids of in-vessel systems (Millner et al., 1994).

One of the problems at large-scale composting operations is the potential for excessive inhalation of airspora by persons near the site of decomposition (Finstein, 1992; Millner et al, 1994). The inhalation by humans and/or animals of high concentrations of airborne spores and/or the presence of a particularly harmful species of thermotolerant fungi, *Aspergillus fumigatus* (AF), can cause organic dust toxic syndrome (ODTS), pulmonary aspergillosis, hypersensitivity pneumonitis (HP), and bovine mycotic abortion in cattle (Millner et al., 1994; Austwick, 1962). The average human is exposed to a mean summer outdoor ambient concentration of 12,500 spores m^{-3}, inhaling $5.7x10^7$ spores at a rate of $2.2x10^4$ spores hr^{-1} (Austwick, 1962). The atmosphere outdoors and indoors contains all of the bioaerosols that are used at composting facilities in varying concentrations, including AF (Millner et al., 1994). Typically, AF composes eight percent of total outdoor airspora, with concentrations ranging from 10 to 10,000 spores m^{-3} (Austwick, 1962). Airborne AF concentrations are high in certain locations, as high as 2,070 CFUs m^{-3} in a barn in the fall or 1,160 CFUs m^{-3} in an attic in the spring (Millner et al. 1994). Workers at composting facilities, mushroom factories, or other spore-rich environments can sometimes experience very high airspora concentrations. In a mushroom house during the winter, workers are exposed to concentrations of over 700,000 viable AF CFUs m^{-3} (Millner et al., 1994).

Normal, ambient spore concentrations can sometimes trigger allergic reactions in sensitive persons, but never any serious illnesses (Millner et al., 1994). Gravesen (1979) estimated threshold concentrations for evoking allergic symptoms to be 100 *Alternaria* spores m^{-3} and 3000 *Cladosporium* spores m^{-3}. No data was collected for *Aspergillus*, but it is reasonable to place an allergic threshold concentration for AF to be similar to *Alternaria* and *Cladosporium* thresholds (Gravesen, 1979).

Generally, spore concentrations decrease significantly as the distance from the spore-producing site increases (ERCO, 1980; E & A Environmental Consultants, 1993). This phenomenon was observed at a compost facility in Westbrook, Maine and a yard waste facility in Connecticut (ERCO, 1980; E & A, 1993)(Table 1).

Table 1: A summary of the data found at a compost facility in Westbrook, Maine and a yard waste facility in Connecticut detailing the average *Aspergillus fumigatus* CFUs collected per m^{-3} in the air at various distances from the compost piles. AF CFUs m^{-3} decrease as distance from the compost piles increases. Energy Resources Co. Inc. conducted the Westbrook study in 1980. E & A Environmental Consultants, Inc. conducted the Connecticut study in 1993.

Distance from compost piles (meters)	**Average CFUs m^{-3}**	
	Compost Facility Westbrook, Maine	Yard Waste Facility Connecticut
30	261	199
90	47	N/A
150	48	4
1500	1	N/A

Agitating compost will trigger the release of spores in extremely high concentrations. These concentrations return to normal levels after the piles settle. At the Beltsville Agricultural Research Center in Maryland, sewer sludge compost released viable spore concentrations of 12,000 CFUs m^{-3} at 3 m downwind from the pile with mechanical agitation performed by a front-end loader and 8,920 CFUs m^{-3} spores at 30 m downwind (Millner, 1980). After 15 minutes, the concentrations of viable spores decreased to 42 m^{-3} at 3 m away from the pile and 14 m^{-3} at 30 m away from the pile (Millner, 1980). Even though agitation releases spore clouds, it reduces the

concentration of AF on the surface of compost piles, diminishing health risks for compost workers (Fischer, 1998).

The risk of being infected from airspora derived from locations with abnormally high spore concentrations, like a composting facility, are extremely rare for anyone other than a worker (ERCO, 1980; E&A, 1993). Clark et al. (1984) found evidence of elevated AF exposure in nose and throat tissues of workers who spend most of their day within 100m of the compost piles and of workers who spend most of their day 100 m or further away from the compost piles. Of the 157 workers studied, only one case of AF infection, aspergillosis, was detected –the subject had a congenital immune defect, making them more likely to become infected (Clark et. al., 1984).

Indirect transport of bioaerosols, including AF, in air suspension from a compost facility was evaluated by WSSC Montgomery County Regional Composting Facility in Silver Spring, Maryland using computer generated air dispersion models and field sampling for one year (Millner et al., 1994). The facility receives 400 wet tons of compost sludge a day (Millner et al. 1994). The study showed that mesophilic fungi, thermophilic fungi, and AF did not demonstrate elevated downwind concentrations at a 95% confidence level (Millner et al., 1994). The geometric average for downwind concentrations was 160 CFUs m^{-3} and the upwind geometric average concentrations was 83 CFUs m^{-3} (Millner et al., 1994).

THIS STUDY

Mississippi Topsoils Inc. is a newly activated composting facility located in Cold Spring, Minnesota. It operates on a hybrid system of in-vessel and static pile composting and utilizes a front-end loader for compost movement and agitation. Approximately 50 tons of organic wastes, including poultry wastes (bodily fluids) and grass and brush trimmings, are treated over a single week. It is a relatively small facility, covering an area of 5.3 acres and located at least 0.5 miles from the nearest residential area. It began operation on October 16, 1999.

Part owner and operator of Mississippi Topsoils Inc., Mr. Brad Matuska, has a contract with the Gold'n Plump Poultry factory a quarter of a mile west from Mississippi Topsoils Inc. He takes biological solid and liquid wastes from Gold'n Plump, transports them with a front-end loader to his site and combines them with plant wastes in a static pile. The wastes are then entered into the enclosed windrows and treated with agitation and aeration. The final product is then sold as soil amendment.

During the public approval process for Mississippi Topsoils Inc., Cold Spring residents criticized composting facilities for having detrimental effects on the health of individuals living around them (asthmatic problems, allergies, etc). Mr. Matuska contended that the operation would not pose a threat to the surrounding populace. The purpose of this study was to see if Mississippi Topsoils Inc. would affect airborne spore loads in the atmosphere around the facility significantly. We measured the relative aeromycological impact of Mississippi Topsoils Inc. on the atmosphere during the months of October and November 1999. We hypothesized that the facility would have little or no effect on airborne spore loads in the surrounding atmosphere because of the weight of evidence in the literature in that direction.

Methods

STUDY SITE

Mississippi Topsoils Inc. is located one mile east of Cold Spring, MN on MN HWY 23, next to the Sauk River (Figure 1). The prevailing winds are from the northwest (B. Matuska, *personal communication*).

Sampling occurred from October 9, 1999 to November 22, 1999. Mississippi Topsoils Inc. activated on October 16, 1999.

The sampling site was approximately 30 meters away from the windrows on the downwind (easterly) side of the compost site. This site was selected since it was in the direct path of the wind after passing through the compost facility (Figure 1).

A small wooden sampling platform was constructed and attached to a metal pole at the sampling site 3.5 meters off of the ground (Figure 2). The platform was constructed to protect samples from precipitation. The platform faced the windrows (northwest).

Petri dishes containing Sabouraud peptone glucose glycerine agar (15 g peptone, 20 g glucose, 5 g glycerine, 12.5 g agar, 1000 mL distilled H_20) were obtained and placed on the sampling platform. Sampling occurred between 1:00pm and 3:30pm, during times when windrow agitation was lowest. At the beginning of this study, before facility activation, as many as nine petri dishes were placed out for as long as two hours. After facility activation, we exposed three petri dishes, each for thirty-minute periods. After exposure, the dishes were sealed with Parafilm™, labeled, and transported in a cooler to a laboratory at St. John's University.

The petri dishes were incubated for 48 hours at room temperature, after which the numbers of filamentous and yeast-like colony-forming units were counted. We defined a colony-forming unit as a distinct, visible mass that typifies fungal growth. Filamentous CFUs were defined as being predominantly white to blue in color and fuzzy in appearance, while yeast-like CFUs were defined as being predominantly yellow to white in color, watery, and spherical in shape.

The technique used to count colonies differed based on the density of the CFUs on the plates. At low CFU density, all of the colonies on a dish were counted. When the CFU density was high, a transparent grid with 20-27 checkerboard-like numbered boxes (0.49 cm^2 or 0.25 cm^2 squares, depending on the density) was placed on the plate and counts were made with the aid of a dissecting microscope.

These data were used to calculate the average number of CFUs m^{-2} hr^{-1} for filamentous, yeast-like, and total CFUs (filamentous plus yeast-like CFUs m^{-2} hr^{-1}) and were plotted over time. The equation for calculating the average number of CFUs m^{-2} hr^{-1} is as follows:

$$\text{CFUs } m^{-2} hr^{-1} = \frac{\text{\# CFUs}}{\text{area cm}^2 \text{ counted 30 min.}^{-1}} * \frac{60 \text{ minutes}}{1 \text{ hour}} * \frac{10{,}000 \text{ cm}^2}{1 \text{ m}^2}$$

To determine the possible influence of climatic variations on spore loads, weather data were received from the nearby (approximately 15 miles from Cold Spring) National Weather Service's St. Cloud outpost (http://climate.umn.edu/doc/regular.htm). Average daily temperature (deg. F), average wind speed (mph), and precipitation (inches) data were downloaded and plotted against filamentous, yeast-like, and total CFUs m^{-2} hr^{-1} counts for average temperature and average wind speed to illustrate this influence.

The relationship between average temperature (deg. F) and average wind speed (mph) with filamentous, yeast-like, and total CFUs m^{-2} hr^{-1} counts was plotted. Significant highs in data were calculated as exceeding one standard deviation from the mean CFUs m^{-2} hr^{-1} for each count and were compared.

The average CFUs m^{-2} hr^{-1} for filamentous, yeast-like, and total counts before and after activation of Mississippi Topsoils Inc. was calculated as well as the percent change for each count. T-tests were run on CFUs m^{-2} hr^{-1} for filamentous, yeast-like, and total counts before and after activation of Mississippi Topsoils Inc. to determine if CFUs m^{-2} hr^{-1} before activation were statistically different than CFUs m^{-2} hr^{-1} after activation.

A multiple linear regression analysis using a backwards elimination technique was performed on the CFUs m^{-2} hr^{-1} data for filamentous, yeast-like, and total counts. Statistical models with the highest adjusted R^2 value were analyzed. Residuals were then examined for normality.

Results

The weather data for daily average temperature (deg. F), average wind speed (mph), and precipitation (inches) were obtained from the National Weather Service outpost in St. Cloud, MN (Figure 3)(Appendix II). Generally, the temperature (deg. F) over the months of October and November 1999 decreased gradually, as would be expected with the shift in seasons and average wind speed fluctuated greatly. The average temperature over this time period was 43.47 deg. F. The average wind speed (mph) over this same time period was constant at 8.117 mph. Precipitation was minimal during the study period.

In general filamentous CFUs m^{-2} hr^{-1} decrease throughout the exposure period, although they do experience a number of peaks (Oct. 9, 14, 22, and Nov. 1) (Figure 4). The highest number of filamentous CFUs m^{-2} hr^{-1} was 499,874 on Oct. 14, and the lowest number of filamentous CFUs m^{-2} hr^{-1} was 3495.6 on Nov. 22.

Yeast CFUs m^{-2} hr^{-1} also decrease throughout the exposure period, but also experience a number of minor peaks and one major peak (Oct. 14, 22, 25, and Nov. 1) (Figure 4). The highest number of yeast-like CFUs m^{-2} hr^{-1} was 613,000 on Oct. 25 and the lowest number of yeast-like CFUs m^{-2} hr^{-1} was 1498 on Nov. 22.

The total number of CFUs m^{-2} hr^{-1} decrease throughout the exposure period and observe peaks in quantity seen in filamentous and yeast-like CFUs m^{-2} hr^{-1} on Oct. 9, 14, 22, 25, and Nov. 1 (Figure 4). The highest number of total CFUs m^{-2} hr^{-1} was 731670.4 (Oct. 25) and the lowest number of total CFUs m^{-2} hr^{-1} was 4993.8 (Nov. 22).

Filamentous, yeast-like, and total CFUs m^{-2} hr^{-1} are plotted versus average temperature (deg. F) data in Figures 5-7, respectively, to make visual comparisons between the data sets. In most cases, every peak in CFUs m^{-2} hr^{-1} can be correlated with a peak temperature date. Peaks in filamentous CFUs m^{-2} hr^{-1} and average temperature for the dates October 9, 14, 25, and November 1 are evident, suggesting that average temperature influenced filamentous CFUs m^{-2}

hr^{-1} over the period studied (Figure 5). Peaks in yeast-like CFUs m^{-2} hr^{-1} and average temperature for the dates October 14, 22, 25, and November 1 are somewhat evident, suggesting that average temperature may have influenced yeast-like CFUs m^{-2} hr^{-1} over the period studied (Figure 6). Peaks in total CFUs m^{-2} hr^{-1} and average temperature are evident for the dates October 9, 14, 22, 25, and November 1, suggesting that average temperature may have influenced total CFUs m^{-2} hr^{-1} over the period studied (Figure 7).

Filamentous, yeast-like, and total CFUs m^{-2} hr^{-1} are plotted versus average wind speed (mph) data in Figures 8-10, respectively, to make visual comparisons between the data sets. Generally, peaks seen in CFUs can be correlated with peaks seen in wind speed. Peaks in both filamentous CFUs m^{-2} hr^{-1} and average wind speed for the dates October 14, 22, and November 1 are evident, suggesting that average wind speed may have influenced filamentous CFUs m^{-2} hr^{-1} over the period studied (Figure 8). Peaks in both yeast-like CFUs m^{-2} hr^{-1} and average wind speed for the dates October 14, 22, and November 1 are evident, suggesting that average wind speed may have influenced yeast-like CFUs m^{-2} hr^{-1} over the period studied (Figure 9). Peaks in both total CFUs m^{-2} hr^{-1} and average wind speed for the dates October 14, 22, and November 1 are evident, suggesting that average wind speed may have influenced total CFUs m^{-2} hr^{-1} over the period studied (Figure 10).

Day-to-day fluctuations in CFUs m^{-2} hr^{-1}, average temperature (deg. F), and average wind speed (mph) made direct visual comparisons of data difficult. Mean and standard deviation values for CFUs m^{-2} hr^{-1}, average temperature (deg. F), and average wind speed (mph) were calculated for the study period (Table 3). Observed values that exceeded one standard deviation from the average over the time period in question were considered significant (Table 3).

While the precipitation data were too few to represent graphically, there was a plausible connection between significant amount of precipitation and peaks in CFUs for October 9 and November 1. Two or three days before these two dates, precipitation occurred in significant amounts (0.44 inches on Oct. 7 and 0.78 inches on Oct. 29).

When comparing filamentous, yeast-like, and total CFUs m^{-2} hr^{-1} with average temperature (deg. F) and average wind speed (mph), no clear cut trend is noticeable (Figure 11-12).

Aeromycological trends do not appear to be influenced by the activation of Mississippi Topsoils Inc. Mean CFUs m^{-2} hr^{-1} before and after activation of the facility for filamentous, yeast-like, and total counts drop after activation (Table 5). Filamentous CFUs m^{-2} hr^{-1} dropped the most after activation (67%), total CFUs m^{-2} hr^{-1} the second most (57.1%), and yeast-like CFUs m^{-2} hr^{-1} dropped the least (33%).

T-test statistical analysis on CFUs m^{-2} hr^{-1} for all counts before and after activation of Mississippi Topsoils Inc. showed statistical differences in the decreases seen for filamentous and total CFUs m^{-2} hr^{-1} (Table 5). This would indicate that the activation of the facility had no effect on filamentous and total CFUs m^{-2} hr^{-1}. There was no statistical difference detected for yeast-like CFUs m^{-2} hr^{-1} for counts before and after facility activation.

Multiple linear regression analysis using backwards elimination on CFUs m^{-2} hr^{-1} for all counts over the entire study period using average temperature (deg. F), average wind speed (mph), precipitation, date, and activation as independent variables articulate the correlations that were supposed in Figures 5-12 and in Tables 3 and 4 (Tables 6 and 7). Regressions run on yeast-like CFU counts showed that increases in average wind speed and average temperature are a significant variable for increasing CFU concentrations (Table 6). Regressions run on total CFU counts showed that increases in average wind speed are significant for increasing CFU concentrations, and that the changes in date (the progression of the seasons from fall to winter) are significant in decreasing CFU concentrations (Table 6). Filamentous CFU counts were considerably affected by the presence of a single, outlying data point (Oct. 25, 613,000 CFUs m^{-2} hr^{-1}) (Table 7). Therefore, regressions were run with and without the outlier (Table 7). The outlier effected R-values and p-values, but same model predictors, average wind speed (mph) and date, were calculated as having significance with and without the outlier (Table 7). Without the

outlier, increases in filamentous CFU counts correlate to increases in average wind speed at a 0.000 p-value and decreases in filamentous CFU counts correlate to the date at a 0.007 p-value (Table 7).

Discussion

The purpose of this study was to measure airborne spore loads before and after the activation of Mississippi Topsoils Inc. to gauge the aeromycological impact that the compost facility had on the atmosphere of Cold Spring, Minnesota. We hypothesized that there would be no noticeable impact on the aeromycology of the atmosphere based on the evidence presented in the literature (Fischer, 1998; Millner et al., 1994; E & A, 1993; Clark et al., 1984; ERCO, 1980; Millner, 1980).

There is no doubt that CFUs m^{-2} hr^{-1} fluctuated over the time period studied, but the reasons behind the fluctuations are not related to Mississippi Topsoils Inc.'s activation (Table 5, 6). The mean CFUs m^{-2} hr^{-1} decreased for all counts and statistical analysis showed that those decreases were statistically different for filamentous and total CFU counts (Table 5, 6). It must also be pointed out that these calculations were derived from a sampling location of 30 meters away from the compost piles. The literature suggests that airborne spore concentrations decrease exponentially as one moves away from the point of spore release (E & A 1993; ERCO 1980; Millner 1980). With Mississippi Topsoils being located approximately 0.5 miles away from the nearest residential area, there is no new aeromycological health risk to the public.

If Mississippi Topsoils Inc. had no impact on spore loads over the time period studied, the fluctuations, then, have to be influenced by weather phenomena. This conclusion is best supported by the literature (Pady 1957; Pady 1956; Pady 1959; Richards 1956) and the data (Figures 7-12, Tables 3-4, 7-8). The days that showed peaks in quantity for all variables studied

seem to illustrate the weather's influence on spore load, since each peak CFU m^{-2} hr^{-1} count occurred on days with a peak in average temperature, average wind speed, or both average temperature and average wind speed (Table 6). However, there are days with above average temperature and average wind speed that do not correlate with a peak in CFUs m^{-2} hr^{-1}, these days occur after November 1 (Figures 7-12, Table 5). It is possible that freezing temperatures, which occurred on November 2 (the low was 22 deg. F), could be responsible for inhibiting spore liberation. Freezing temperatures would have prevented the gelatinizing process that occurs in the tissues located between spore/conidia and sporangiophore/conidiophore, making spore liberation impossible for some fungal species.

Significant high days aside, multiple regression analysis of the independent variables for all counts showed that average wind speed was significant in causing CFU m^{-2} hr^{-1} fluctuations (Tables 7-8). Average temperature was found to be significant in causing yeast-like CFU m^{-2} hr^{-1} fluctuations and the gradual climatic change with the seasons was significant in causing filamentous and total $CFUs^{-2}$ hr^{-1} (Tables 7-8).

A final explanation for the fluctuations seen in CFU concentrations could be the occasional turning of the compost piles from front-end loader usage. This activity usually took place sometime before or after the sampling period of 1:00pm-3:30 pm, however aberrations in schedule could have occurred and turning could have overlapped with the sampling period on significant high days. There is no record of when turning occurred at Mississippi Topsoils Inc. on a daily basis throughout the study period.

There are some areas in this study that could be improved. We realized that the best procedure for measuring spore concentrations present in the atmosphere would be to use exposed petri dishes as well as spore identification on greased microscope slides (Pady 1956, 1959). We exposed four microscope slides coated with silicone grease per day for 24-hour periods. We placed two slides on a passive catch stand and two slides on a wind driven sampler for active sampling. However, the identification of the spores was problematic and we abandoned that

aspect of the study and focused solely on the petri dishes. Identification of the colonies collected in this study would also have been beneficial for specifying certain pathogens present in the air around Mississippi Topsoils Inc.

An analytical setback came when trying to compare our data with the literature. Everything in this study was recorded in CFUs m^{-2} hr^{-1} while everything in the literature was recorded in CFUs m^{-3}, since volumetric sampling was used. This made it difficult to compare data. In the future, airborne particle samplers that can measure the number of particles per volume of air should be utilized.

Ultimately, it would have been beneficial to collect more data before the activation of the facility or to collect background CFU concentrations at a location somewhere in Cold Spring as a control. We collected eight days worth of data before the activation. Additional data would have been useful in better measuring the ambient spore densities present in the air before activation and solidified the comparison made in the summary table. This suggests that more studies could be performed detailing the background levels of spore concentrations and the level of spore concentrations released at the facility.

Conclusion

A survey of atmospheric spore concentrations was conducted during the months of October and November 1999 at the newly activated compost facility, Mississippi Topsoils Inc. located in Cold Spring, Minnesota. Petri dishes containing Sabouraud agar were exposed for thirty-minutes and incubated; the number of filamentous, yeast-like, and total colony forming units (CFUs) was determined. Meteorological data was also utilized from the National Weather Service St. Cloud monitoring station and compared to CFUs m^{-2} hr^{-1}. Weather phenomena, such

as average temperature and average wind speed, impacted the fluctuations in CFUs m^{-2} hr^{-1} over the time period studied. The activation of Mississippi Topsoils Inc. had no aeromycological impact on the atmosphere 30 meters downwind of the facility.

Acknowledgements

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Figure 1: A diagram of Mississippi Topsoils Inc. composting facility, located one mile east of Cold Spring, Minnesota on MN HWY 23, next to the Sauk River. Gold'n Plump Poultry is located approximately one-fourth of a mile to the west. The sampling site is located on the downwind side of Mississippi Topsoils in order to sample the air traveling directly from the compost facility. This representation is not to scale.

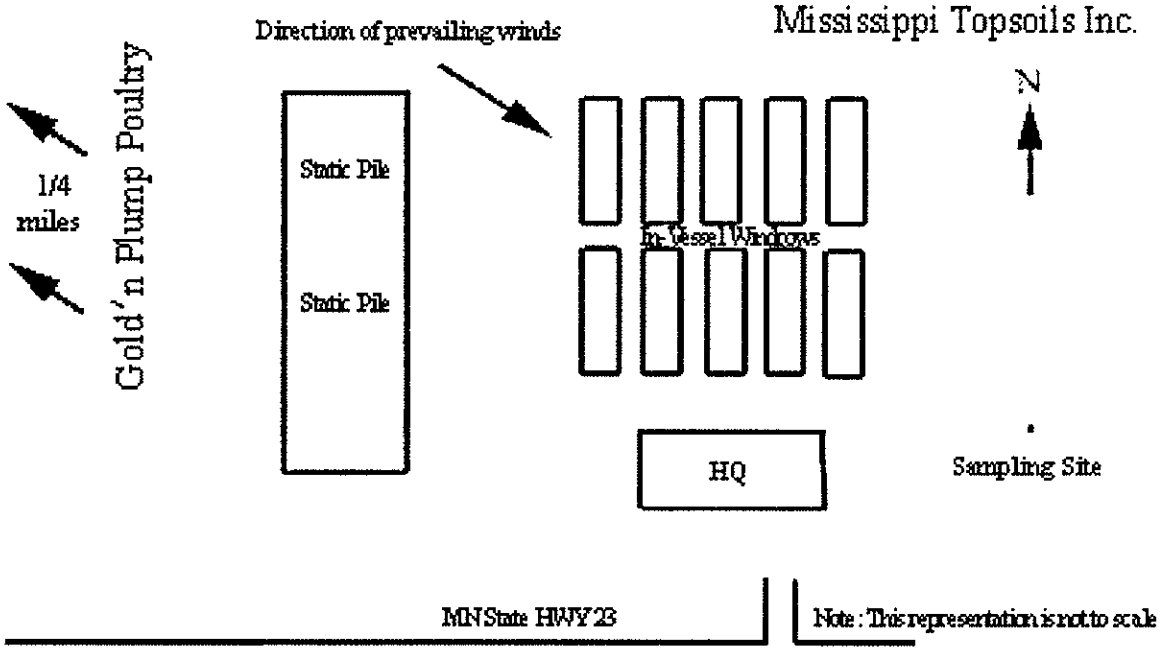

Figure 2: A diagram of the wooden sampling platform used to collect aeromycological data at Mississippi Topsoils Inc, in Cold Spring, Minnesota from October 9, 1999 to November 22, 1999. The dimensions for the sampling platform were 20 cm x 25 cm x 30 cm. The sampling platform was 3.5 m off of the ground, attached to a metal pole. Petri dishes were placed under the roof and secured with clothespins throughout the sampling period.

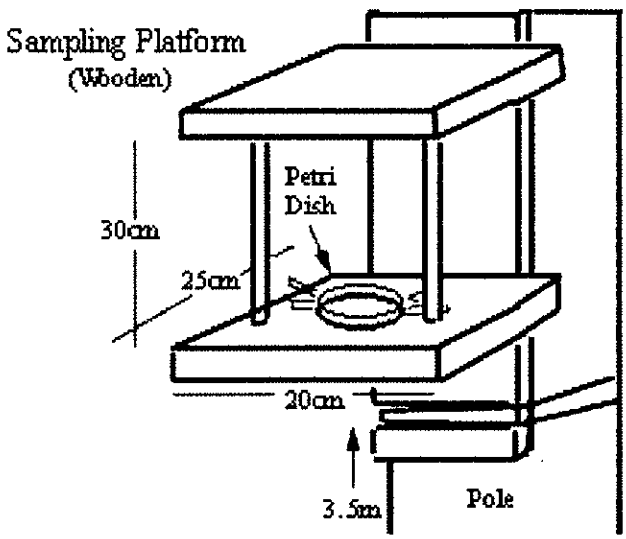

Figure 3: Average daily temperature (deg. F) and average daily wind speed (mph) recorded from October 1, 1999 to November 22, 1999 at the St. Cloud, Minnesota National Weather Service outpost.

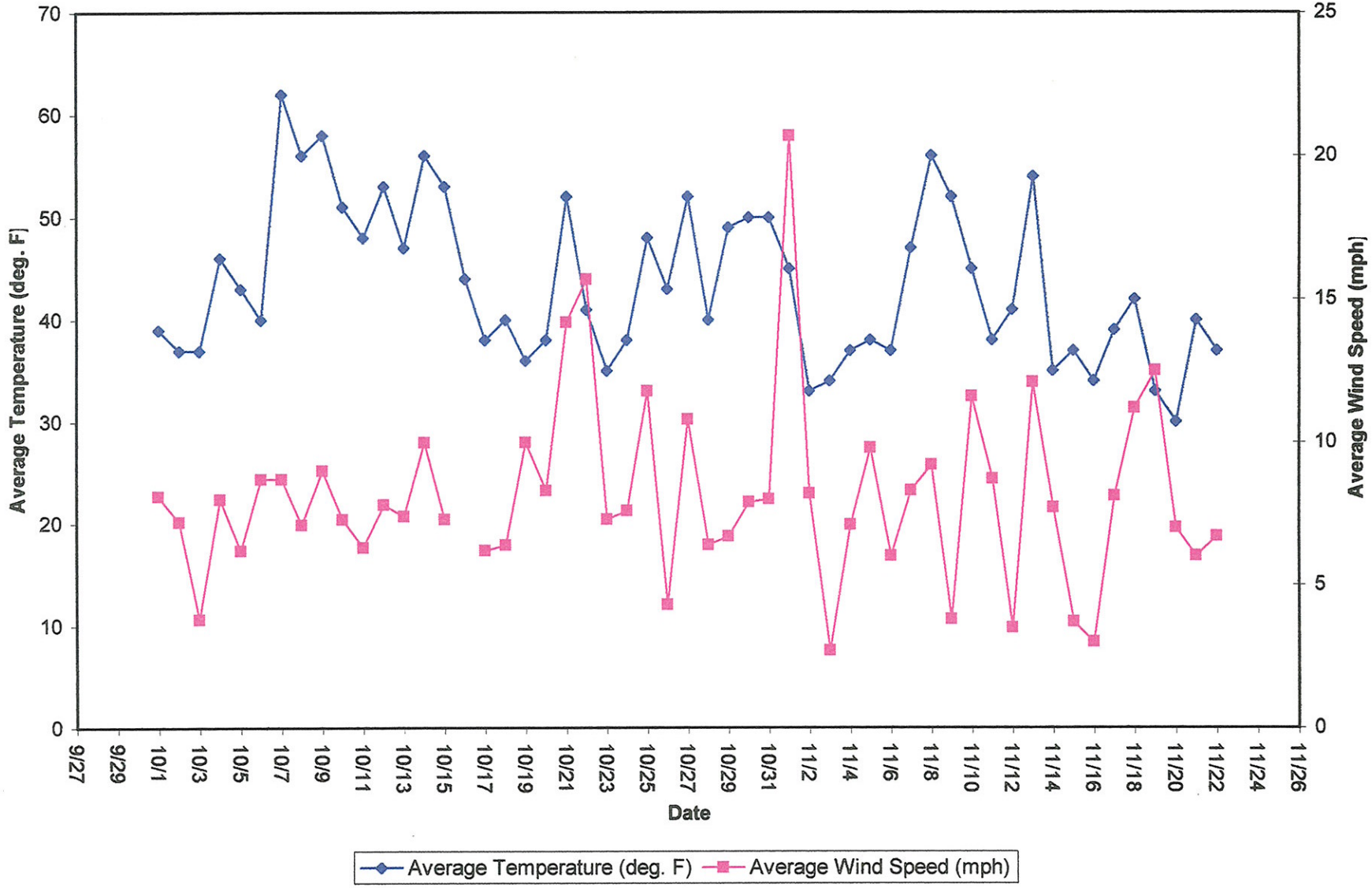

Figure 4: Filamentous, yeast-like, and total CFUs m-2 hr-1 measured in an aeromycological study at Mississippi Topsoils Inc. located in Cold Spring, Minnesota from October 9, 1999 to November 22, 1999. The number of CFUs m-2 hr-1 over the time period decreased for all counts despite the peaks observed on October 9, 14, 22, 25, and November 1.

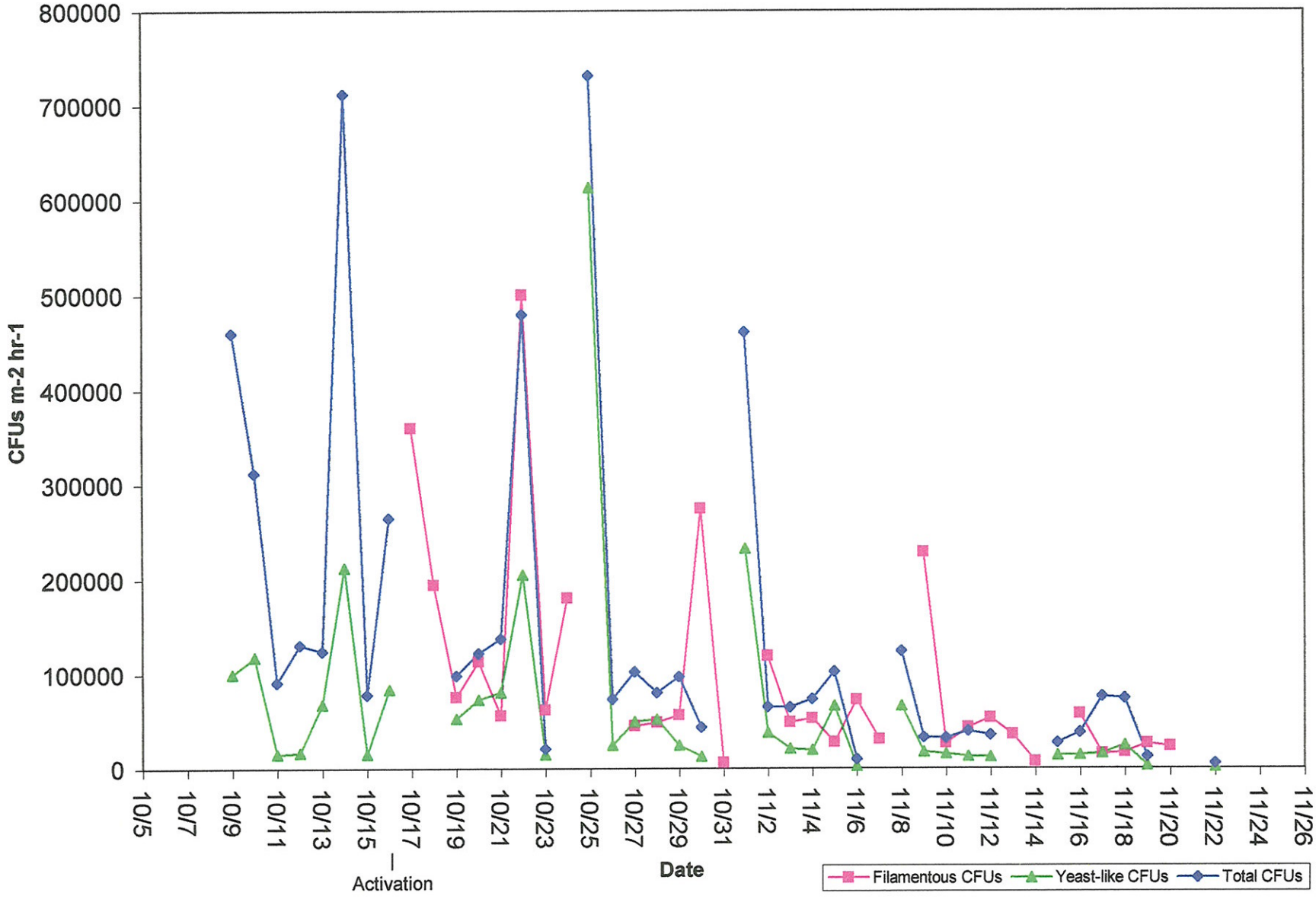

Figure 5: Filamentous CFUs m-2 hr-1 and average temperature (deg. F) data plotted together from an aeromycological study performed at Mississippi Topsoils Inc. in Cold Spring, Minnesota from October 9, 1999 to November 22, 1999. Average temperature fluctuated over the time period.

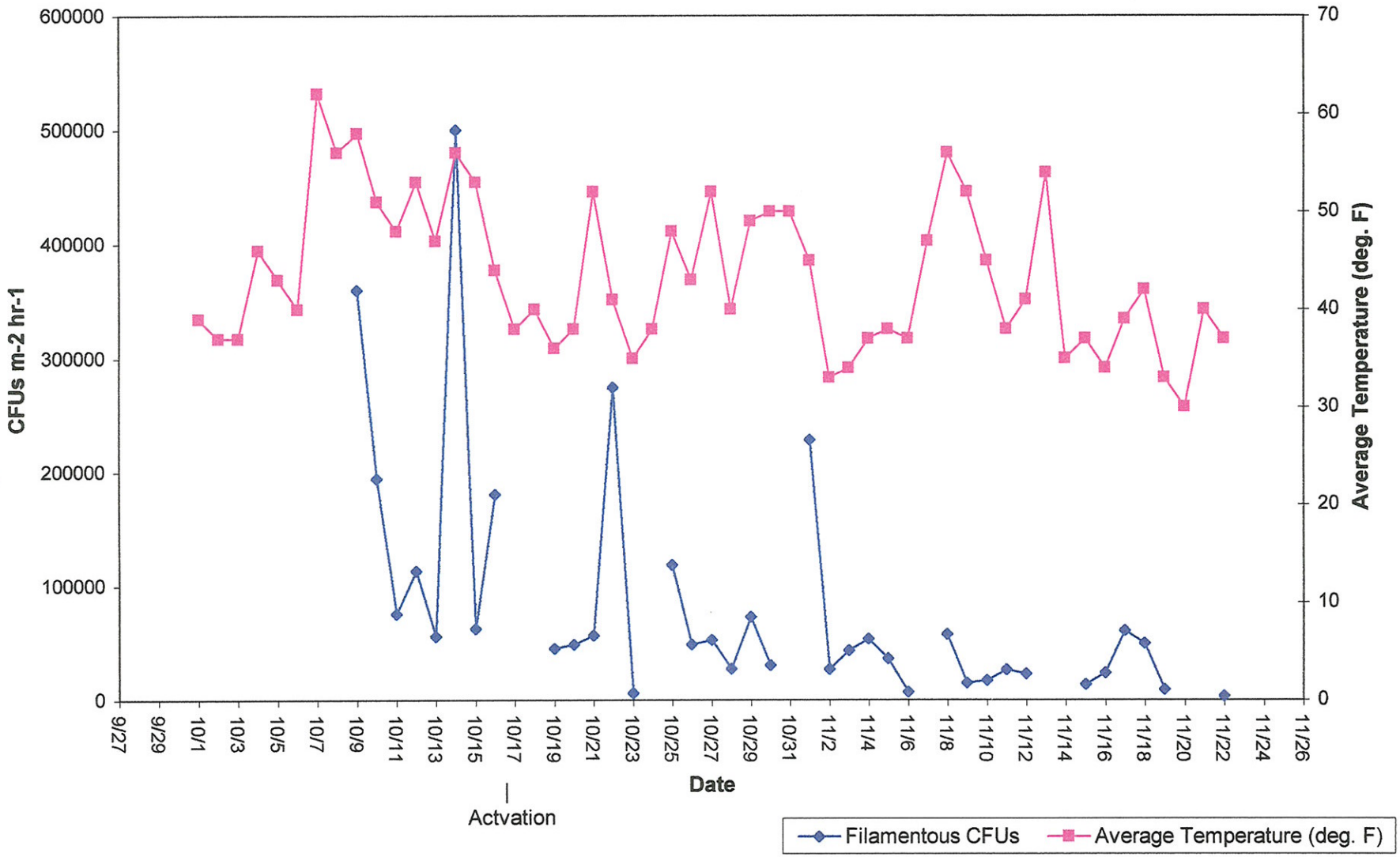

Figure 6: Yeast-like CFUs m-2 hr-1 and average temperature (deg. F) data plotted together from an aeromycological study performed at Mississippi Topsoils Inc. in Cold Spring, Minnesota from October 9, 1999 to November 22, 1999. Average temperature fluctuated over the time period.

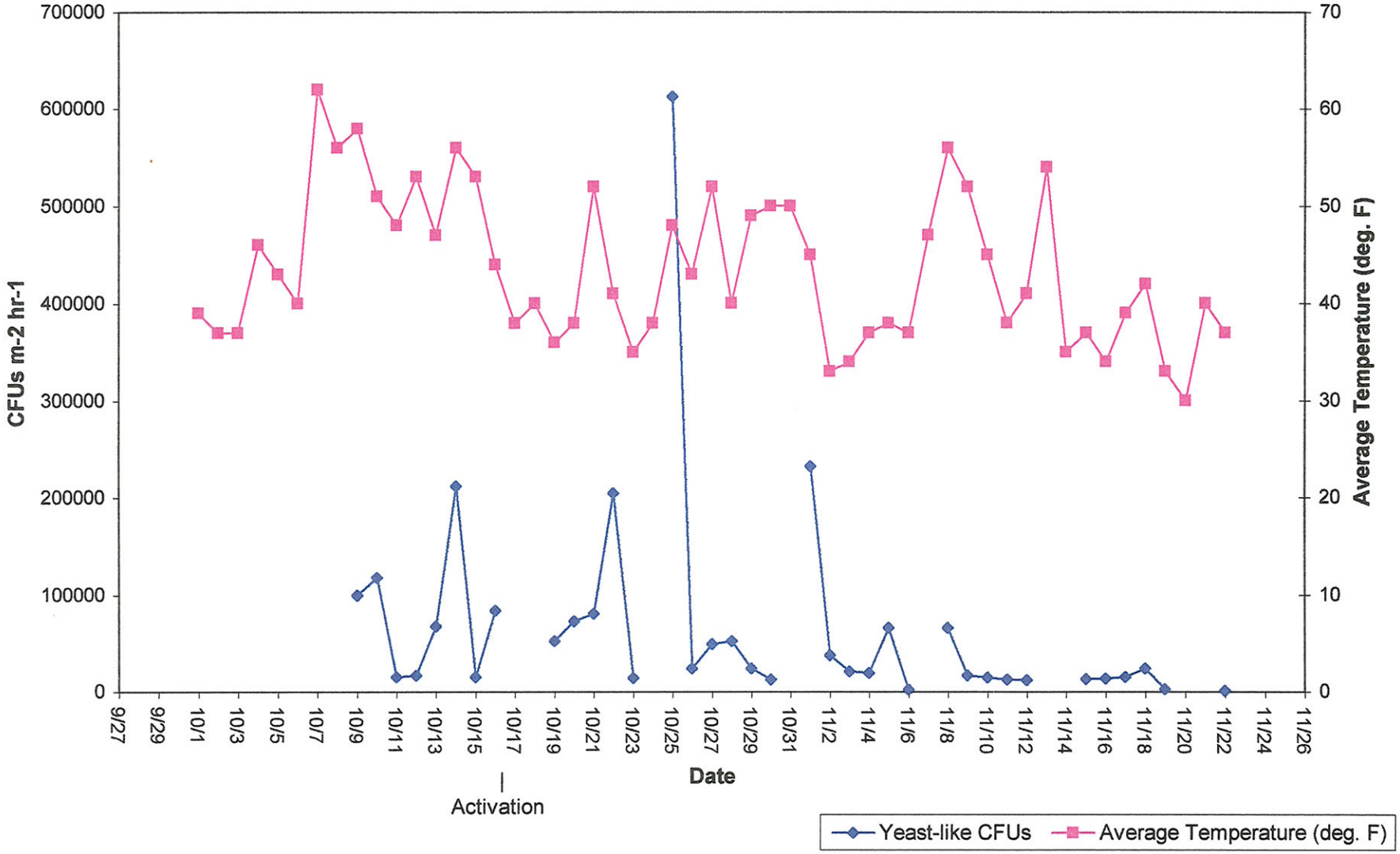

Figure 7: Total CFUs m-2 hr-1 and average temperature (deg. F) data plotted together from an aeromycological study performed at Mississippi Topsoils Inc. in Cold Spring, Minnesota from October 9, 1999 to November 22, 1999. Average temperature fluctuated over the time period.

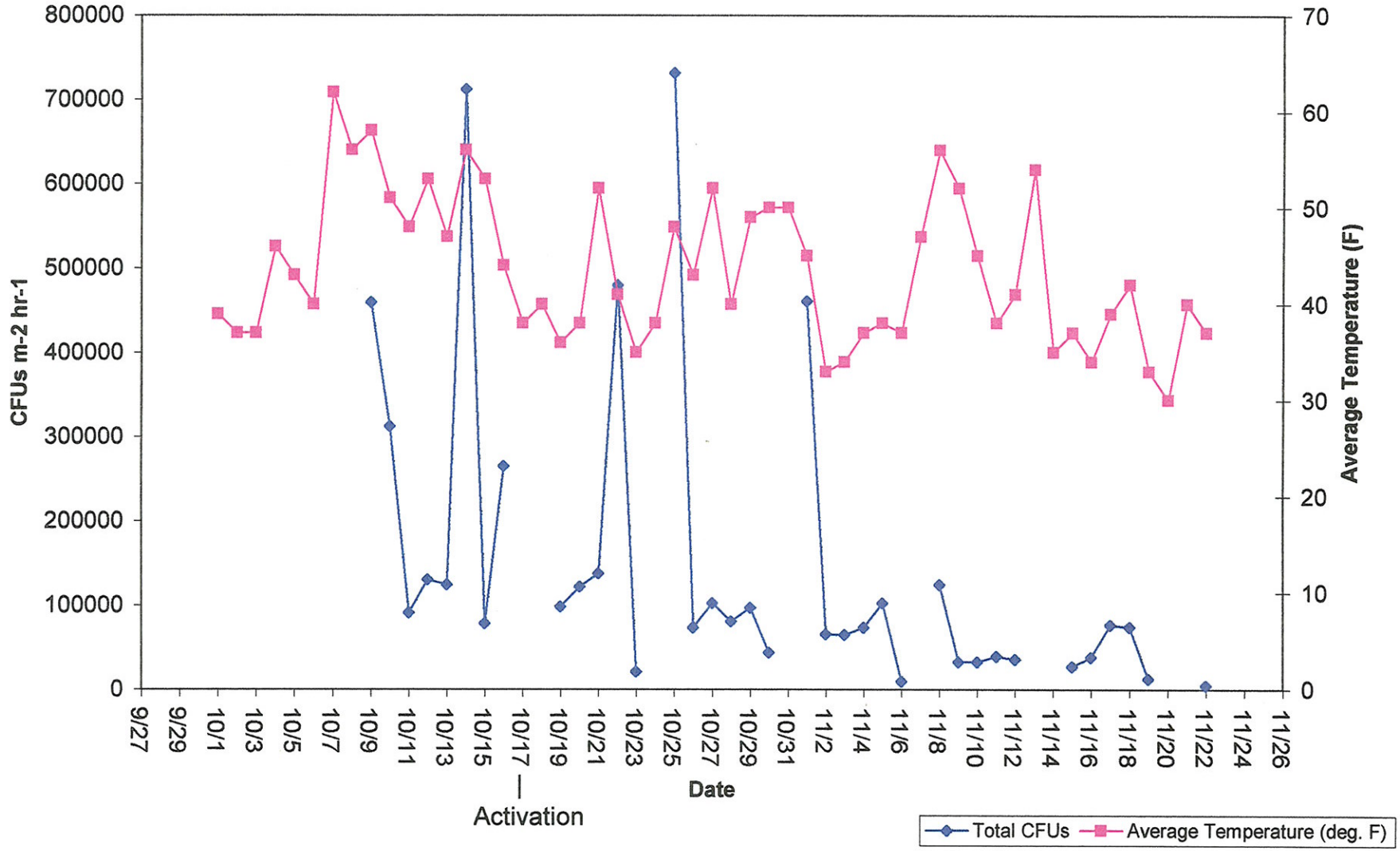

Figure 8: Filamentous CFUs m-2 hr-1 and average wind speed (mph) data plotted together from an aeromycological study performed at Mississippi Topsoils Inc. in Cold Spring, Minnesota from October 9, 1999 to November 22, 1999. Average wind speed fluctuated greatly over the time period.

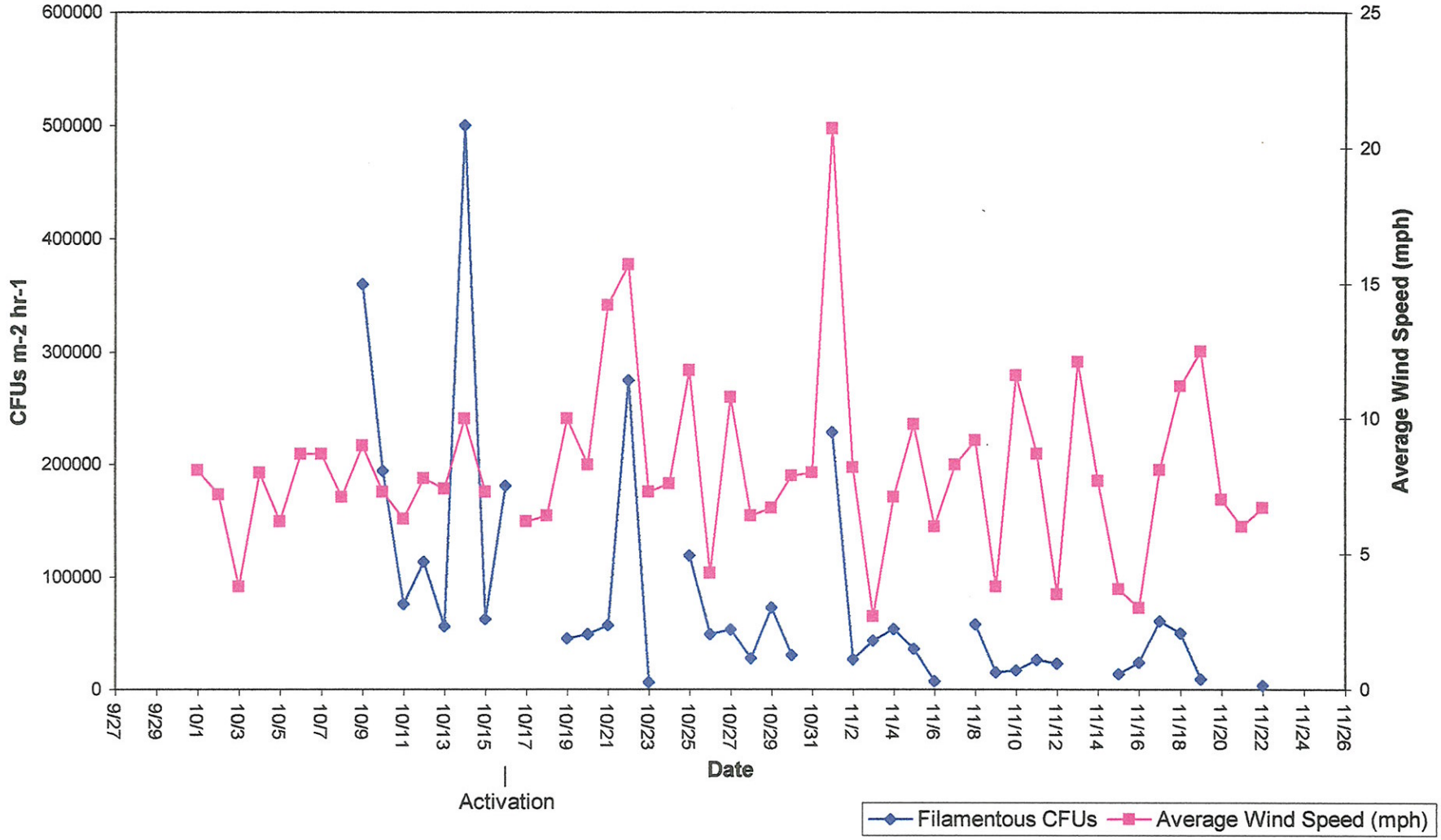

Figure 9: Yeast-like CFUs m-2 hr-1 and average wind speed (mph) data plotted together from an aeromycological study performed at Mississippi Topsoils Inc. in Cold Spring, Minnesota from October 9, 1999 to November 22, 1999. Average wind speed fluctuated greatly over the time period.

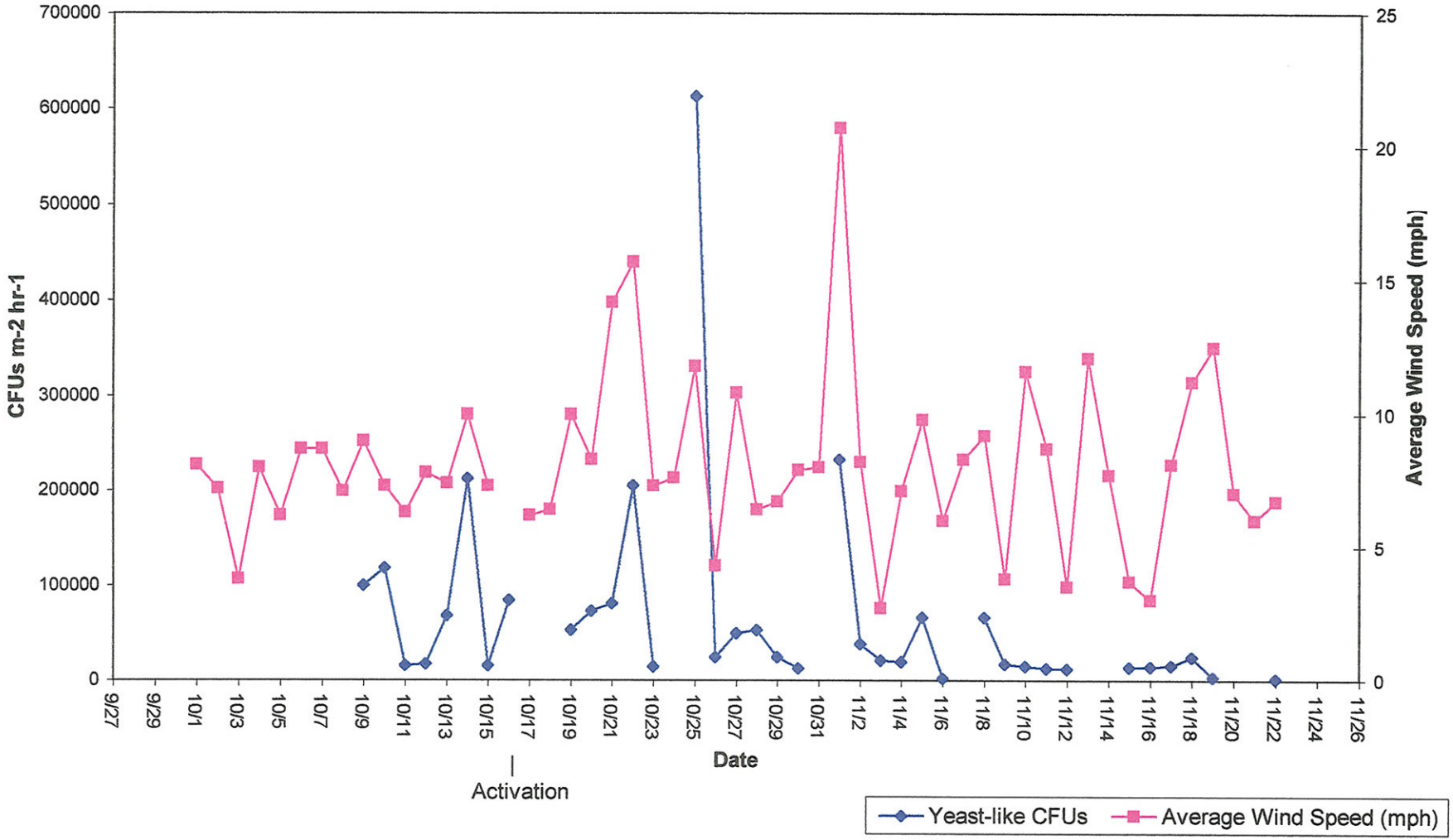

Figure 10: Total CFUs m-2 hr-1 and average wind speed (mph) data plotted together from an aeromycological study performed at Mississippi Topsoils Inc. in Cold Spring, Minnesota from October 9, 1999 to November 22, 1999. Average wind speed fluctuated greatly over the time period.

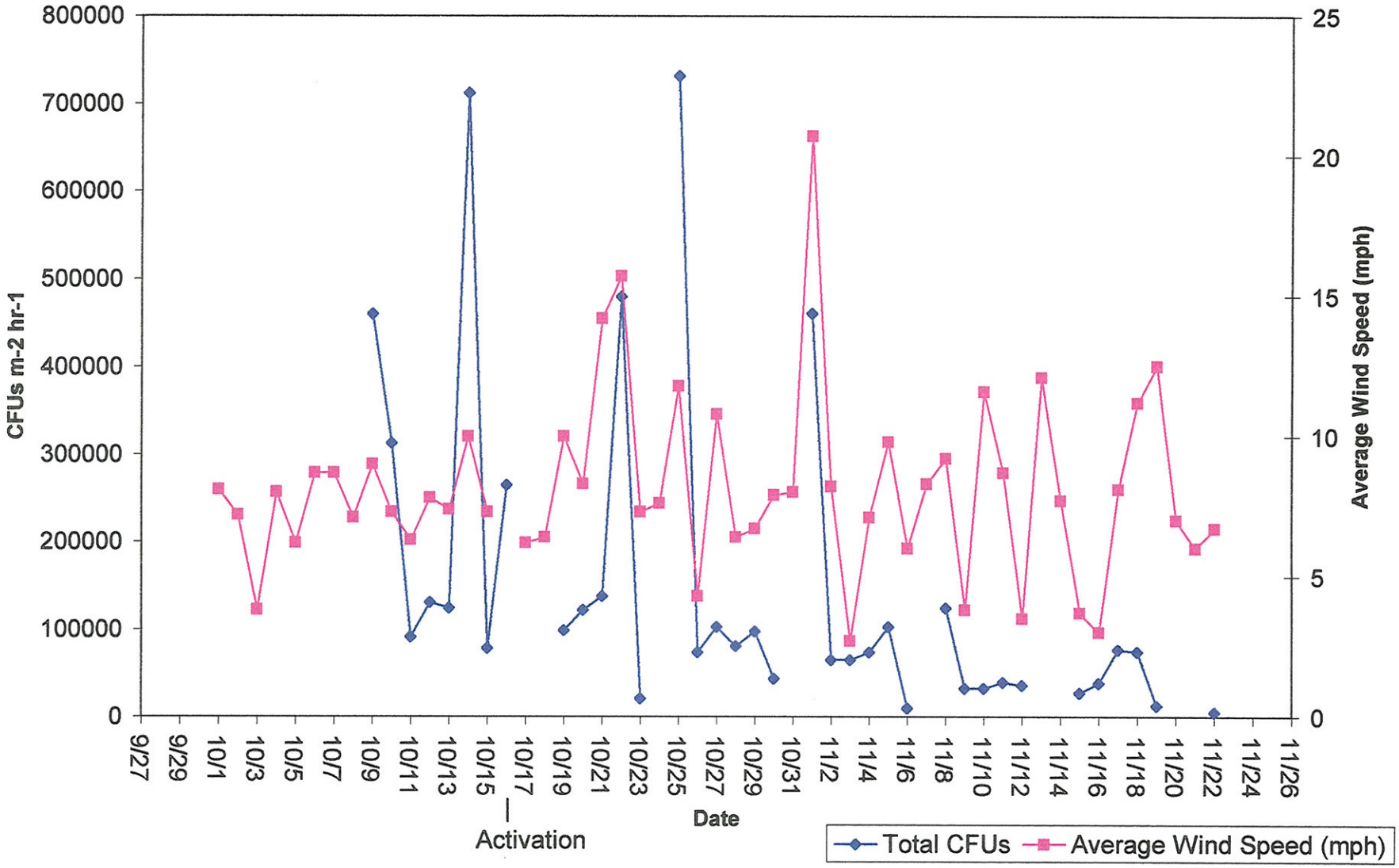

Figure 11: Filamentous, yeast-like and total CFUs m-2 hr-1 counts plotted against average temperature (deg. F) for an aeromycological study performed at Mississippi Topsoils Inc. located in Cold Spring, Minnesota over the dates of October 9, 1999 to November 22, 1999. Of the points over the 55 degree F mark, only four exceed the 300,000 CFUs m-2 hr-1 mark, suggesting that there isn't a very strong correlation between CFUs m-2 hr-1 and average temperature for the data, but an undisputable trend in the data is not observed.

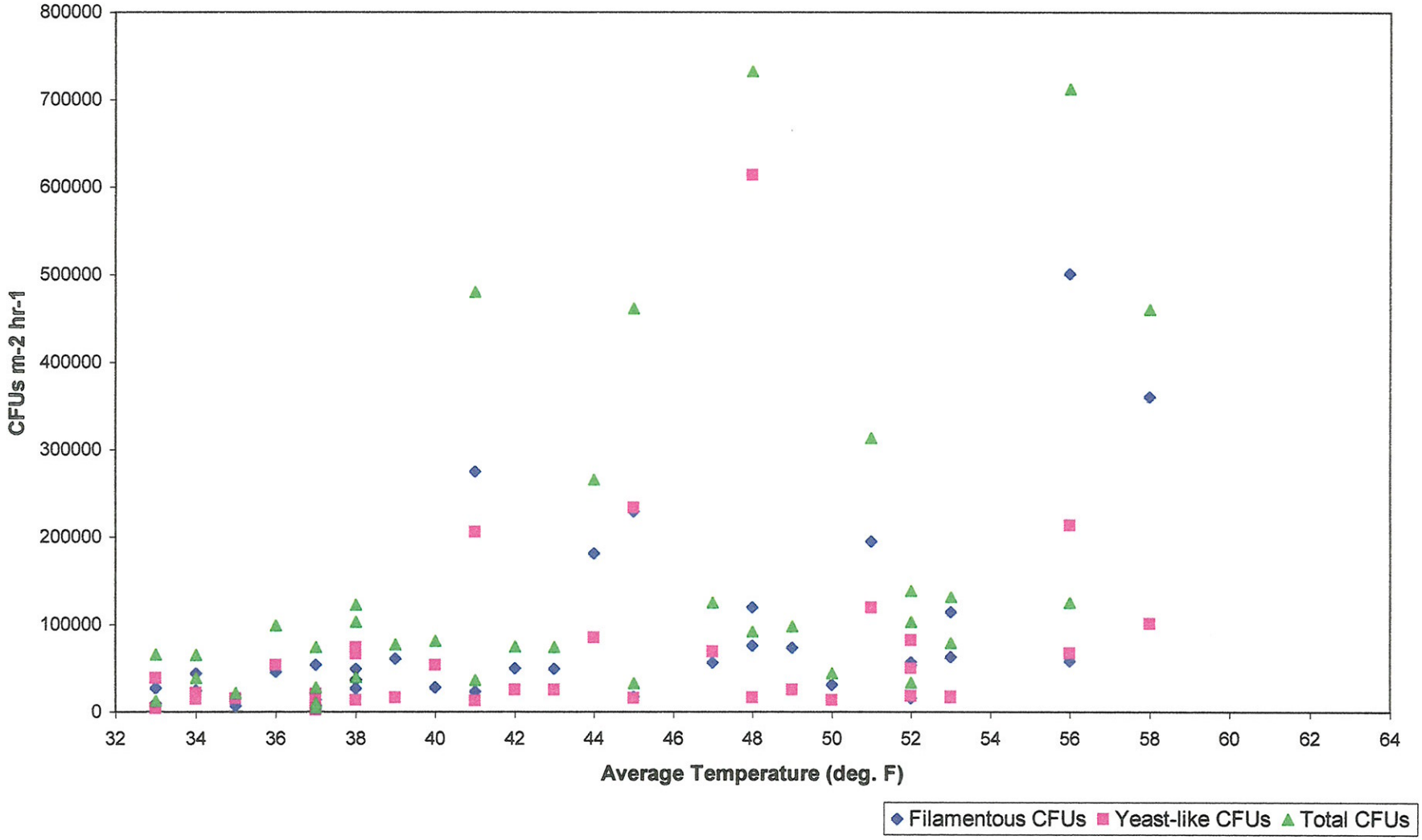

Figure 12: Filamentous, yeast-like and total CFUs m-2 hr-1 counts plotted against average wind speed (mph) for an aeromycological study performed at Mississippi Topsoils Inc. located in Cold Spring, Minnesota over the dates of October 9, 1999 to November 22, 1999. The highest CFUs m-2 hr-1 were observed at above average wind speeds and the strongest wind speed points were observed with above average CFUs m-2 hr-1, but an undisputable trend in the data is not observed.

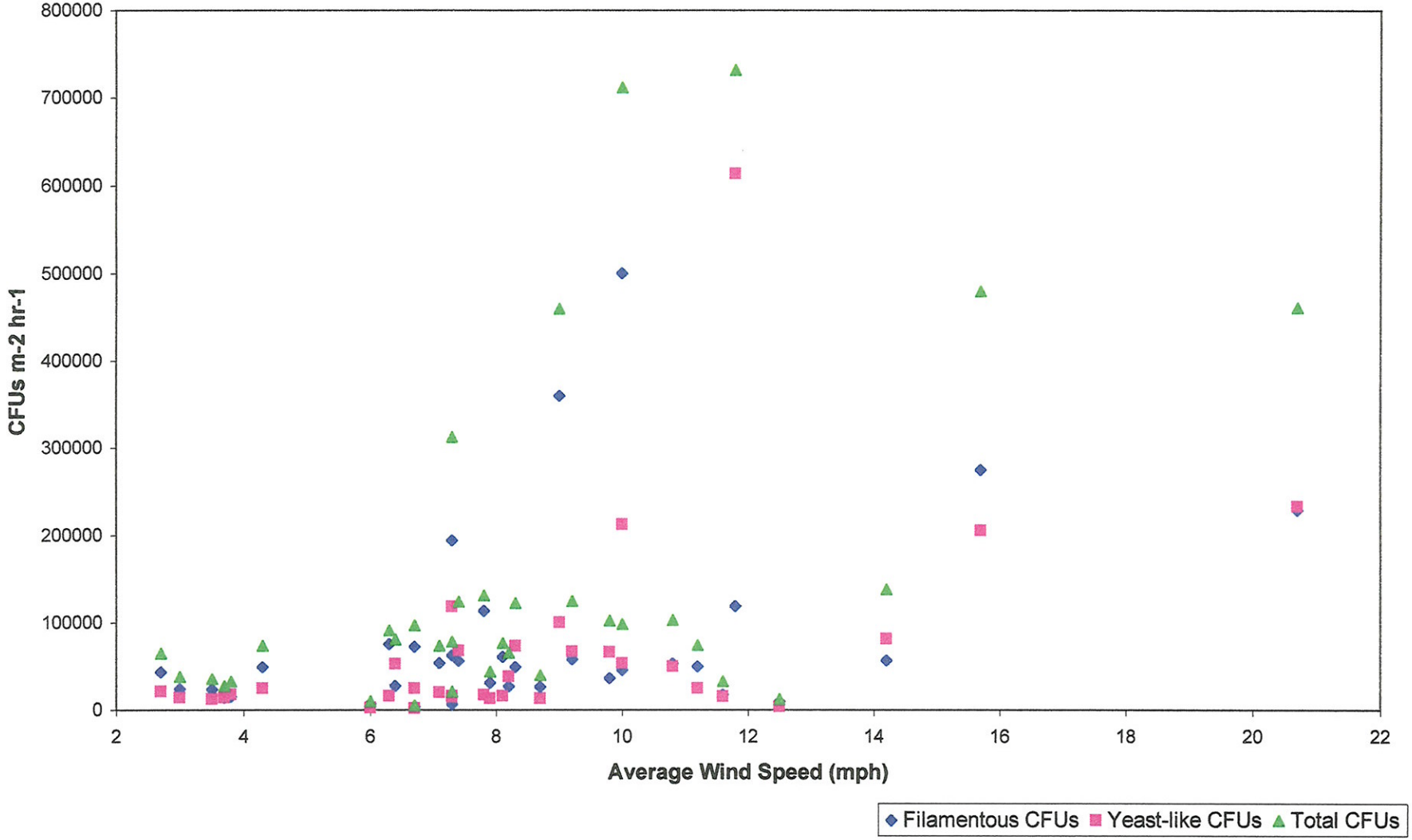

Table 2: A summary of the aeromycological data collected at Mississippi Topsoils Inc. compost facility before and after the facility's activation during October 9, 1999 to November 22, 1999. The average daily CFUs m^{-2} hr^{-1} is represented for filamentous, yeast-like, and total CFU counts. Note the units have been converted from CFUs cm^{-2} hr^{-1}, as was represented in the raw data, to CFUs m^{-2} hr^{-1}.

Activation	Date	CFUs m^{-2} hr^{-1}		
		Filamentous	Yeast-like	Total
Before	10/9	359666.7	100000	459667
	10/10	194111.1	118111.1	312222
	10/11	75585.8	15621.1	91206.9
	10/12	113378.7	17132.8	130511
	10/13	55933.5	68027.2	123961
	10/14	499874	212144.1	712018
	10/15	62484.3	15621.1	78105.3
	10/16	180398.1	84152.2	264550
After	10/19	45443.2	52933.8	98377
	10/20	48938.8	72908.9	121848
	10/21	56679.2	80898.9	137578
	10/22	274376.4	204837.5	479214
	10/23	6242.2	14731.6	20973.8
	10/25	118669.7	613000.8	731670
	10/26	48938.8	24469.4	73408.2
	10/27	52933.8	49687.9	102622
	10/28	27715.4	52684.1	80399.5
	10/29	72659.2	24469.4	97128.6
	10/30	30711.6	12983.8	43695.4
	11/1	228269.1	232300.3	460569
	11/2	26966.3	38202.3	65168.5
	11/3	43445.7	21223.5	64669.2
	11/4	53682.9	19725.3	73408.2
	11/5	36204.7	66167.3	102372
	11/6	7241	2496.9	9737.8
	11/8	57678	66417	124095
	11/9	15231	17478.2	32709.1
	11/10	17228.5	15231	32459.4
	11/11	26466.9	12983.8	39450.7
	11/12	23221	12484.4	35705.4
	11/15	13732.8	13732.8	27465.7
	11/16	23970	14232.2	38202.2
	11/17	60674.2	15730.3	76404.5
	11/18	49687.9	24469.4	74157.3
	11/19	9238.5	3246	12484.4
	Average	**83921.5**	**67001**	**150922**

Table 3: Calculations for determining "significant highs" in filamentous, yeast-like, and total CFUs m^{-2} hr^{-1} as well as average temperature (deg. F) and average wind speed (mph) for an aeromycological study performed at Mississippi Topsoils in Cold Spring, Minnesota over the dates of October 9, 1999 to November 22, 1999. "Significant highs" were defined as quantities exceeding one standard deviation above the average over the time period in question. The dates on which the peaks were observed are listed.

	Mean for the Time Period	**Standard Deviation**	**Mean + Standard Deviation**	**Number of Significant Highs**
Filamentous CFUs m^{-2} hr^{-1}	83921.51	107151.83	191073	**4** (Oct. 9, 14, 22, Nov. 1)
Yeast-like CFUs m^{-2} hr^{-1}	67000.95	110353.44	177354	**4** (Oct. 14, 22, 25, Nov. 1)
Total CFUs m^{-2} hr^{-1}	150922.5	187141.5	338064	**5** (Oct. 9, 14, 22, 25, Nov. 1)
Average Temperature (deg. F)	43.5	7.683	51.153	**9** (Oct. 8, 9, 12, 14, 15, 21, 27, Nov. 8, 9, 13)
Average Wind Speed (mph)	8.1	3.22	11.34	**8** (Oct. 21, 22, 25, Nov. 1, 10, 13, 18, 19)

Table 4: The average number of CFUs m^{-2} hr^{-1} before and after activation of Mississippi Topsoils Inc. in Cold Spring, Minnesota from October 9, 1999 to November 22, 1999 for filamentous, yeast-like, and total CFU counts and the percent change between before and after average CFU number for each count. From each count, the average CFUs m^{-2} hr^{-1} decreased after activation. The percent change was highest filamentous CFUs.

	Average CFUs m^{-2} hr^{-1}		Percent Change
	Before Activation	After Activation	
Filamentous	192679	63615	-67
Yeast-like	78851	52848	-33
Total	**271530**	**116463**	**-57.1**

Table 5: Statistical results from t-tests assuming unequal variances and one tail critical values analyzing the statistical differences between the average number of CFUs m^{-2} hr^{-1} before and after activation of Mississippi Topsoils Inc., located in Cold Spring, MN for filamentous, yeast-like, and total CFU counts from October 9, 1999 to November 22, 1999. There were statistical differences between the data before and after activation for yeast-like CFUs m^{-2} hr^{-1} and total CFUs m^{-2} hr^{-1}, but filamentous CFUs m^{-2} hr^{-1} showed no statistical difference.

	T-statistic	T-critical Value	Statistical Difference
Filamentous CFUs	0.462	1.721	No
Yeast-like CFUs	2.429	1.859	Yes
Total CFUs	1.842	1.833	Yes

Table 6: Statistical results from a multiple linear regression using a backwards elimination technique for yeast-like and total CFUs m^{-2} hr^{-1} sampled at Mississippi Topsoils Inc. located in Cold Spring, MN from October 9, 1999 to November 22, 1999. The increase seen in yeast-like CFU counts in relation to the increases in average wind speed (mph) and average temperature (deg. F) are significant. The increase seen in total CFU counts in relation to the increase in average wind speed is significant, as well as the decrease in total CFU counts in relation to the date.

	R^2	Adjusted R^2	Model Predictors	B Value	Standard Deviation	P Value
Yeast-like	.491	.442	Wind Speed	11338	3863.7	0.006
			Activation	-122882	2328.3	0.298
			Temperature	2466.2	42734.5	0.007
Total	.446	.392	Wind Speed	21702.4	6902.6	0.004
			Temperature	5090.9	4028.2	0.216
			Date	-4381.4	2334.4	0.070

Table 7: Statistical results from a multiple linear regression using a backwards elimination technique for filamentous CFUs m^{-2} hr^{-1} sampled at Mississippi Topsoils Inc. located in Cold Spring, MN from October 9, 1999 to November 22, 1999. Filamentous CFU counts were analyzed with and without a single, outlying data point (Oct. 25, 613,000). The outlier effected R-values and P-values, but same model predictors, average wind speed (mph) and date, were calculated as having significance with and without the outlier. Without the outlier, increases in filamentous CFU counts correlate to increases in average wind speed at a 0.000 significance value and decreases in filamentous CFU counts correlate to the date at a 0.007.

	R^2	Adjusted R^2	Model Predictors	B Value	Standard Deviation	P Value
Filamentous w/ outlier	.277	.231	Wind Speed	13430	4556.6	0.006
			Date	-1962.8	1313	0.145
Filamentous w/o outlier	.552	.524	Wind Speed	9867.8	1942.8	0.000
			Date	-1611.9	554.2	0.007

Appendix I.1-1

The following is a record of the raw data collected on **October 9**, 1999 in an aeromycological study performed at Mississippi Topsoils Inc. compost facility in Cold Spring, Minnesota during the period of October 9, 1999 to November 22, 1999. Colony forming units were counted on **2** plates using a grid marked with **20** boxes measuring **0.25** cm^2 each, with a total area measured of **5** cm^2 after being exposed for **0.5** hours. This record occurred **before** the compost facility began operation.

Sample Box Number	Plate 1			Plate 2			Sum Totals		
	Filamentous CFUs	Yeast-like CFUs	Total CFUs	Filamentous CFUs	Yeast-like CFUs	Total CFUs	Filamentous CFUs	Yeast-like CFUs	Total CFUs
1	6	2	8	6	4	10	12	6	18
2	7	3	10	5	2	7	12	5	17
3	5	3	8	7	1	8	12	4	16
4	6	4	10	8	1	9	14	5	19
5	7	3	10	8	3	11	15	6	21
6	7	5	12	7	1	8	14	6	20
7	4	3	7	12	2	14	16	5	21
8	4	3	7	5	2	7	9	5	14
9	5	1	6	8	3	11	13	4	17
10	5	1	6	6	2	8	11	3	14
11	5	2	7	6	2	8	11	4	15
12	7	3	10	5	2	7	12	5	17
13	4	2	6	10	1	11	14	3	17
14	7	3	10	5	2	7	12	5	17
15	5	1	6	6	2	8	11	3	14
16	4	5	9	9	1	10	13	6	19
17	7	3	10	6	2	8	13	5	18
18	3	4	7	6	0	6	9	4	13
19	8	2	10	3	1	4	11	3	14
20	6	1	7	7	4	11	13	5	18
Total	112	54	166	135	38	173	247	92	339
Avg. cm^{-2} hr^{-1}	44.8	21.6	66.4	54	15.2	69.2	98.8	36.8	135.6

Appendix I.1-2

The following is a record of the raw data collected on **October 9**, 1999 in an aeromycological study performed at Mississippi Topsoils Inc. compost facility in Cold Spring, Minnesota during the period of October 9, 1999 to November 22, 1999. Colony forming units were counted on **2** plates using a grid marked with **20** boxes measuring **0.25** cm^2 each, with a total area measured of **5** cm^2 after being exposed for **1** hour. This record occurred **before** the compost facility began operation.

Sample Box Number	Plate 1			Plate 2			Sum Totals		
	Filamentous CFUs	Yeast-like CFUs	Total CFUs	Filamentous CFUs	Yeast-like CFUs	Total CFUs	Filamentous CFUs	Yeast-like CFUs	Total CFUs
1	15	3	18	9	2	11	24	5	29
2	11	4	15	11	0	11	22	4	26
3	11	3	14	8	2	10	19	5	24
4	5	2	7	6	3	9	11	5	16
5	12	3	15	12	0	12	24	3	27
6	8	1	9	13	3	16	21	4	25
7	10	3	13	11	3	14	21	6	27
8	8	6	14	7	1	8	15	7	22
9	12	4	16	11	4	15	23	8	31
10	5	4	9	10	5	15	15	9	24
11	9	2	11	8	1	9	17	3	20
12	4	3	7	6	5	11	10	8	18
13	8	2	10	11	4	15	19	6	25
14	9	4	13	11	2	13	20	6	26
15	9	3	12	19	0	19	28	3	31
16	10	2	12	13	3	16	23	5	28
17	5	1	6	9	2	11	14	3	17
18	8	1	9	5	3	8	13	4	17
19	11	4	15	12	3	15	23	7	30
20	10	2	12	13	4	17	23	6	29
Total	180	57	237	205	50	255	385	107	492
Avg. $cm^{-2} hr^{-1}$	36	11.4	47.4	41	10	51	77	21.4	98.4

Appendix I.1-3

The following is a record of the raw data collected on **October 9**, 1999 in an aeromycological study performed at Mississippi Topsoils Inc. compost facility in Cold Spring, Minnesota during the period of October 9, 1999 to November 22, 1999. Colony forming units were counted on **2** plates using a grid marked with **20** boxes measuring **0.25** cm^2 each, with a total area measured of **5** cm^2 after being exposed for **2** hours. This record occurred **before** the compost facility began operation.

Sample Box Number	Plate 1			Plate 2			Sum Totals		
	Filamentous CFUs	Yeast-like CFUs	Total CFUs	Filamentous CFUs	Yeast-like CFUs	Total CFUs	Filamentous CFUs	Yeast-like CFUs	Total CFUs
1	28	4	32	12	5	17	40	9	49
2	20	2	22	19	5	24	39	7	46
3	25	5	30	23	1	24	48	6	54
4	22	6	28	16	2	18	38	8	46
5	14	5	19	19	2	21	33	7	40
6	24	3	27	17	3	20	41	6	47
7	18	5	23	17	2	19	35	7	42
8	17	1	18	16	1	17	33	2	35
9	21	6	27	15	2	17	36	8	44
10	28	2	30	23	4	27	51	6	57
11	29	1	30	12	2	14	41	3	44
12	27	5	32	7	4	11	34	9	43
13	17	2	19	11	2	13	28	4	32
14	10	3	13	20	4	24	30	7	37
15	26	5	31	20	4	24	46	9	55
16	16	5	21	15	6	21	31	11	42
17	26	2	28	15	2	17	41	4	45
18	17	5	22	15	3	18	32	8	40
19	21	0	21	19	5	24	40	5	45
20	19	2	21	24	4	28	43	6	49
Total	425	69	494	335	63	398	760	132	892
Avg. cm^{-2} hr^{-1}	42.5	6.9	49.4	33.5	6.3	39.8	76	13.2	89.2

Daily average CFUs cm^{-2} hr^{-1} for October 9, 1999

	Filamentous CFUs	Yeast-like CFUs	Total CFUs
Average CFUs cm^{-2} hr^{-1}	43.1	42.8	45.96667

Appendix I.2-1

The following is a record of the raw data collected on **October 10**, 1999 in an aeromycological study performed at Mississippi Topsoils Inc. compost facility in Cold Spring, Minnesota during the period of October 9, 1999 to November 22, 1999. Colony forming units were counted on **2** plates using a grid marked with **20** boxes measuring **0.25** cm^2 each, with a total area measured of **5** cm^2 after being exposed for **0.5** hours. This record occurred **before** the compost facility began operation.

Sample Box Number	Plate 1			Plate 2			Sum Totals		
	Filamentous CFUs	Yeast-like CFUs	Total CFUs	Filamentous CFUs	Yeast-like CFUs	Total CFUs	Filamentous CFUs	Yeast-like CFUs	Total CFUs
1	1	3	4	2	0	2	3	3	6
2	2	1	3	1	2	3	3	3	6
3	3	4	7	0	0	0	3	4	7
4	2	7	9	2	0	2	4	7	11
5	1	1	2	2	2	4	3	3	6
6	3	0	3	2	0	2	5	0	5
7	2	0	2	1	1	2	3	1	4
8	3	1	4	2	1	3	5	2	7
9	2	1	3	1	0	1	3	1	4
10	1	2	3	2	2	4	3	4	7
11	3	2	5	3	1	4	6	3	9
12	3	2	5	3	0	3	6	2	8
13	2	4	6	4	2	6	6	6	12
14	1	1	2	4	0	4	5	1	6
15	1	3	4	2	2	4	3	5	8
16	1	3	4	2	1	3	3	4	7
17	1	1	2	2	1	3	3	2	5
18	2	3	5	1	1	2	3	4	7
19	0	1	1	1	0	1	1	1	2
20	1	2	3	3	0	3	4	2	6
Total	35	42	77	40	16	56	75	58	133
Avg. cm^{-2} hr^{-1}	14	16.8	30.8	16	6.4	22.4	30	23.2	53.2

Appendix I.2-2

The following is a record of the raw data collected on **October 10**, 1999 in an aeromycological study performed at Mississippi Topsoils Inc. compost facility in Cold Spring, Minnesota during the period of October 9, 1999 to November 22, 1999. Colony forming units were counted on **2** plates using a grid marked with **20** boxes measuring **0.25** cm^2 each, with a total area measured of **5** cm^2 after being exposed for **1** hour. This record occurred **before** the compost facility began operation.

Sample Box Number	Plate 1			Plate 2			Sum Totals		
	Filamentous CFUs	Yeast-like CFUs	Total CFUs	Filamentous CFUs	Yeast-like CFUs	Total CFUs	Filamentous CFUs	Yeast-like CFUs	Total CFUs
1	2	0	2	2	0	2	4	0	4
2	2	3	5	2	0	2	4	3	7
3	0	0	0	2	0	2	2	0	2
4	3	0	3	2	1	3	5	1	6
5	2	0	2	4	2	6	6	2	8
6	2	0	2	3	3	6	5	3	8
7	5	2	7	3	1	4	8	3	11
8	3	0	3	1	1	2	4	1	5
9	1	0	1	4	3	7	5	3	8
10	0	0	0	1	0	1	1	0	1
11	3	1	4	3	0	3	6	1	7
12	2	2	4	3	1	4	5	3	8
13	1	1	2	2	1	3	3	2	5
14	8	1	9	1	1	2	9	2	11
15	1	2	3	3	1	4	4	3	7
16	2	0	2	1	0	1	3	0	3
17	3	0	3	4	2	6	7	2	9
18	2	0	2	5	1	6	7	1	8
19	3	4	7	4	1	5	7	5	12
20	4	0	4	3	2	5	7	2	9
Total	49	16	65	53	21	74	102	37	139
Avg. $cm^{-2} hr^{-1}$	9.8	3.2	13	10.6	4.2	14.8	20.4	7.4	27.8

Appendix I.2-3

The following is a record of the raw data collected on **October 10**, 1999 in an aeromycological study performed at Mississippi Topsoils Inc. compost facility in Cold Spring, Minnesota during the period of October 9, 1999 to November 22, 1999. Colony forming units were counted on **2** plates using a grid marked with **20** boxes measuring **0.25** cm^2 each, with a total area measured of **5** cm^2 after being exposed for **1.5** hours. This record occurred **before** the compost facility began operation.

Sample Box Number	Plate 1			Plate 2			Sum Totals		
	Filamentous CFUs	Yeast-like CFUs	Total CFUs	Filamentous CFUs	Yeast-like CFUs	Total CFUs	Filamentous CFUs	Yeast-like CFUs	Total CFUs
1	3	0	3	4	1	5	7	1	8
2	1	1	2	1	0	1	2	1	3
3	6	4	10	3	3	6	9	7	16
4	2	0	2	4	0	4	6	0	6
5	4	0	4	2	0	2	6	0	6
6	3	0	3	1	0	1	4	0	4
7	6	2	8	7	2	9	13	4	17
8	2	0	2	4	0	4	6	0	6
9	6	1	7	15	3	18	21	4	25
10	0	0	0	10	0	10	10	0	10
11	6	1	7	2	3	5	8	4	12
12	5	1	6	4	1	5	9	2	11
13	3	0	3	4	0	4	7	0	7
14	4	1	5	2	0	2	6	1	7
15	2	1	3	4	2	6	6	3	9
16	5	2	7	5	1	6	10	3	13
17	5	1	6	2	1	3	7	2	9
18	2	2	4	6	4	10	8	6	14
19	4	1	5	5	1	6	9	2	11
20	3	1	4	1	0	1	4	1	5
Total	72	19	91	86	22	108	158	41	199
Avg. cm^{-2} hr^{-1}	9.6	2.533	12.133	11.466	2.933	14.4	21.066	5.466	26.533

Daily average CFUs cm^{-2} hr^{-1} for October 10, 1999

	Filamentous CFUs	Yeast-like CFUs	Total CFUs
Average CFUs cm^{-2} hr^{-1}	19.411	11.811	31.222

Appendix I.3

The following is a record of the raw data collected on **October 11**, 1999 in an aeromycological study performed at Mississippi Topsoils Inc. compost facility in Cold Spring, Minnesota during the period of October 9, 1999 to November 22, 1999. Colony forming units were counted on **3** plates using a grid marked with **27** boxes measuring **0.49** cm^2 each, with a total area measured of **13.23** cm^2 after being exposed for **0.5** hours. This record occurred **before** the compost facility began operation.

Samp. #*	Plate 1			Plate 2			Plate 3			Sum Totals		
	F.** CFUs	Y.*** CFUs	T.**** CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs
1	0	0	0	0	2	2	1	1	2	1	3	4
2	2	0	2	2	1	3	1	1	2	5	2	7
3	3	0	3	0	0	0	2	0	2	5	0	5
4	2	0	2	4	0	4	1	1	2	7	1	8
5	1	1	2	1	2	3	1	0	1	3	3	6
6	3	0	3	4	0	4	2	0	2	9	0	9
7	1	1	2	2	0	2	1	0	1	4	1	5
8	2	0	2	3	0	3	0	0	0	5	0	5
9	0	0	0	0	0	0	2	1	3	2	1	3
10	4	0	4	1	0	1	2	0	2	7	0	7
11	8	2	10	1	0	1	4	0	4	13	2	15
12	3	1	4	3	1	4	2	0	2	8	2	10
13	2	0	2	3	1	4	2	1	3	7	2	9
14	1	0	1	3	1	4	0	1	1	4	2	6
15	0	0	0	3	0	3	2	1	3	5	1	6
16	5	0	5	1	0	1	2	0	2	8	0	8
17	4	1	5	0	0	0	2	0	2	6	1	7
18	2	0	2	2	0	2	1	0	1	5	0	5
19	2	0	2	3	0	3	2	0	2	7	0	7
20	1	1	2	2	0	2	2	0	2	5	1	6
21	1	0	1	1	0	1	2	0	2	4	0	4
22	2	1	3	1	0	1	3	0	3	6	1	7
23	3	1	4	2	0	2	1	1	2	6	2	8
24	1	1	2	1	0	1	1	0	1	3	1	4
25	0	0	0	2	0	2	3	0	3	5	0	5
26	2	0	2	1	1	2	4	1	5	7	2	9
27	0	2	2	1	1	2	2	0	2	3	3	6
Total	55	12	67	47	10	57	48	9	57	150	31	181
Avg. cm^{-2} hr^{-1}	8.314	1.814	10.12	7.105	1.511	8.616	7.256	1.360	8.616	22.67	4.686	27.36

NOTE:
* Sample Box Number is hereafter referred to as "Samp. #"
** Filamentous CFUs are hereafter referred to as "F. CFUs"
*** Yeast-like CFUs are hereafter referred to as "Y. CFUs"
**** Total CFUs are hereafter referred to as "T. CFUs"

Daily average CFUs cm^{-2} hr^{-1} for October 11, 1999

	Filamentous CFUs	Yeast-like CFUs	Total CFUs
Average CFUs cm^{-2} hr^{-1}	7.558	1.562	9.120

Appendix I.4

The following is a record of the raw data collected on **October 12**, 1999 in an aeromycological study performed at Mississippi Topsoils Inc. compost facility in Cold Spring, Minnesota during the period of October 9, 1999 to November 22, 1999. Colony forming units were counted on **3** plates using a grid marked with **27** boxes measuring **0.49** cm^2 each, with a total area measured of **13.23** cm^2 after being exposed for **0.5** hours. This record occurred **before** the compost facility began operation.

Samp. #	Plate 1			Plate 2			Plate 3			Sum Totals		
	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs
1	1	0	1	1	0	1	4	0	4	6	0	6
2	3	1	4	1	0	1	2	0	2	6	1	7
3	2	2	4	2	0	2	4	0	4	8	2	10
4	2	0	2	3	1	4	2	0	2	7	1	8
5	1	1	2	3	1	4	1	1	2	5	3	8
6	1	1	2	4	0	4	4	0	4	9	1	10
7	2	0	2	2	0	2	3	0	3	7	0	7
8	3	0	3	1	0	1	1	1	2	5	1	6
9	4	1	5	1	0	1	2	0	2	7	1	8
10	4	0	4	2	1	3	0	0	0	6	1	7
11	3	0	3	4	0	4	3	1	4	10	1	11
12	2	0	2	2	0	2	2	0	2	6	0	6
13	2	0	2	4	1	5	4	0	4	10	1	11
14	3	0	3	3	0	3	5	2	7	11	2	13
15	1	1	2	3	2	5	3	1	4	7	4	11
16	3	1	4	4	0	4	3	0	3	10	1	11
17	3	1	4	2	0	2	6	1	7	11	2	13
18	3	1	4	3	0	3	3	0	3	9	1	10
19	0	0	0	4	1	5	3	0	3	7	1	8
20	1	1	2	2	1	3	6	0	6	9	2	11
21	6	1	7	2	0	2	4	0	4	12	1	13
22	2	1	3	6	0	6	2	1	3	10	2	12
23	0	0	0	5	1	6	3	0	3	8	1	9
24	4	0	4	6	1	7	1	0	1	11	1	12
25	4	0	4	3	0	3	1	0	1	8	0	8
26	1	0	1	4	1	5	3	0	3	8	1	9
27	1	2	3	6	0	6	5	0	5	12	2	14
Total	62	15	77	83	11	94	80	8	88	225	34	259
Avg. cm^{-2} hr^{-1}	9.372	2.267	11.64	12.54	1.662	14.21	12.09	1.209	13.30	34.01	5.139	39.15

Daily average CFUs cm^{-2} hr^{-1} for October 12, 1999

	Filamentous CFUs	Yeast-like CFUs	Total CFUs
Average CFUs cm^{-2} hr^{-1}	**7.558**	**1.562**	**9.120**

Appendix I.5

The following is a record of the raw data collected on **October 13**, 1999 in an aeromycological study performed at Mississippi Topsoils Inc. compost facility in Cold Spring, Minnesota during the period of October 9, 1999 to November 22, 1999. Colony forming units were counted on **3** plates using a grid marked with **27** boxes measuring **0.49** cm^2 each, with a total area measured of **13.23** cm^2 after being exposed for **0.5** hours. This record occurred **before** the compost facility began operation.

Samp. #	Plate 1			Plate 2			Plate 3			Sum Totals		
	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs
1	2	1	3	1	5	6	2	1	3	5	7	12
2	1	1	2	1	3	4	0	0	0	2	4	6
3	1	1	2	1	4	5	2	4	6	4	9	13
4	3	0	3	0	2	2	2	2	4	5	4	9
5	1	1	2	1	2	3	2	2	4	4	5	9
6	1	3	4	2	1	3	1	2	3	4	6	10
7	1	2	3	1	4	5	0	0	0	2	6	8
8	4	2	6	1	3	4	1	0	1	6	5	11
9	2	1	3	0	1	1	0	3	3	2	5	7
10	2	2	4	3	1	4	0	0	0	5	3	8
11	2	1	3	2	3	5	0	2	2	4	6	10
12	0	3	3	0	1	1	0	1	1	0	5	5
13	1	4	5	3	0	3	1	2	3	5	6	11
14	2	1	3	3	0	3	3	1	4	8	2	10
15	2	2	4	1	3	4	0	1	1	3	6	9
16	2	1	3	1	2	3	0	1	1	3	4	7
17	1	2	3	0	4	4	1	1	2	2	7	9
18	1	3	4	0	1	1	2	2	4	3	6	9
19	1	0	1	1	1	2	1	1	2	3	2	5
20	1	0	1	0	0	0	2	0	2	3	0	3
21	2	2	4	3	1	4	1	1	2	6	4	10
22	1	2	3	1	3	4	1	2	3	3	7	10
23	2	1	3	3	2	5	1	3	4	6	6	12
24	2	1	3	2	1	3	1	1	2	5	3	8
25	2	3	5	1	1	2	1	0	1	4	4	8
26	1	4	5	2	0	2	3	2	5	6	6	12
27	3	2	5	5	3	8	0	2	2	8	7	15
Total	44	46	90	39	52	91	28	37	65	111	135	246
Avg. cm^{-2} hr^{-1}	6.651	6.953	13.60	5.895	7.860	13.75	4.232	5.593	9.826	16.78	20.40	37.18

Daily average CFUs cm^{-2} hr^{-1} for October 13, 1999

	Filamentous CFUs	Yeast-like CFUs	Total CFUs
Average CFUs cm^{-2} hr^{-1}	5.593348	6.802721	12.39607

Appendix I.6

The following is a record of the raw data collected on **October 14**, 1999 in an aeromycological study performed at Mississippi Topsoils Inc. compost facility in Cold Spring, Minnesota during the period of October 9, 1999 to November 22, 1999. Colony forming units were counted on **3** plates using a grid marked with **27** boxes measuring **0.49** cm^2 each, with a total area measured of **13.23** cm^2 after being exposed for **0.5** hours. This record occurred **before** the compost facility began operation.

Samp. #	Plate 1			Plate 2			Plate 3			Sum Totals		
	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs
1	18	3	21	20	2	22	18	11	29	56	16	72
2	13	3	16	14	3	17	12	5	17	39	11	50
3	5	2	7	11	2	13	8	9	17	24	13	37
4	6	4	10	12	3	15	10	8	18	28	15	43
5	12	4	16	7	0	7	12	7	19	31	11	42
6	10	3	13	13	1	14	15	14	29	38	18	56
7	12	3	15	13	4	17	14	8	22	39	15	54
8	6	1	7	23	5	28	18	5	23	47	11	58
9	12	1	13	20	5	25	15	4	19	47	10	57
10	5	1	6	5	1	6	7	6	13	17	8	25
11	12	6	18	18	3	21	10	8	18	40	17	57
12	13	5	18	14	5	19	15	6	21	42	16	58
13	7	2	9	12	4	16	18	12	30	37	18	55
14	12	3	15	8	4	12	25	5	30	45	12	57
15	20	6	26	10	0	10	14	6	20	44	12	56
16	7	3	10	1	4	5	15	11	26	23	18	41
17	15	2	17	8	4	12	13	8	21	36	14	50
18	10	3	13	11	4	15	20	12	32	41	19	60
19	14	1	15	14	4	18	13	11	24	41	16	57
20	14	6	20	14	3	17	20	11	31	48	20	68
21	12	5	17	12	3	15	16	14	30	40	22	62
22	9	5	14	8	2	10	13	7	20	30	14	44
23	6	6	12	8	5	13	10	11	21	24	22	46
24	12	6	18	6	1	7	9	9	18	27	16	43
25	8	4	12	13	3	16	13	5	18	34	12	46
26	12	6	18	3	8	11	10	8	18	25	22	47
27	16	4	20	17	4	21	16	15	31	49	23	72
Total	298	98	396	315	87	402	379	236	615	992	421	1413
Avg. cm^{-2} hr^{-1}	45.04	14.81	59.86	47.61	13.15	60.77	57.29	35.67	92.97	149.9	63.64	213.6

Daily average CFUs cm^{-2} hr^{-1} for October 14, 1999

	Filamentous CFUs	Yeast-like CFUs	Total CFUs
Average CFUs cm^{-2} hr^{-1}	49.9874	21.21441	71.20181

Appendix I.7

The following is a record of the raw data collected on **October 15**, 1999 in an aeromycological study performed at Mississippi Topsoils Inc. compost facility in Cold Spring, Minnesota during the period of October 9, 1999 to November 22, 1999. Colony forming units were counted on **3** plates using a grid marked with **27** boxes measuring **0.49** cm^2 each, with a total area measured of **13.23** cm^2 after being exposed for **0.5** hours. This record occurred **before** the compost facility began operation.

Samp. #	Plate 1			Plate 2			Plate 3			Sum Totals		
	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs
1	3	0	3	0	1	1	0	1	1	3	2	5
2	1	0	1	0	0	0	2	0	2	3	0	3
3	2	1	3	2	0	2	1	0	1	5	1	6
4	2	0	2	2	0	2	1	0	1	5	0	5
5	3	2	5	2	0	2	2	0	2	7	2	9
6	0	0	0	1	1	2	1	0	1	2	1	3
7	1	0	1	1	1	2	4	0	4	6	1	7
8	1	0	1	1	0	1	2	0	2	4	0	4
9	1	1	2	2	2	4	2	0	2	5	3	8
10	3	1	4	2	0	2	0	0	0	5	1	6
11	1	0	1	0	0	0	2	0	2	3	0	3
12	1	0	1	1	0	1	1	0	1	3	0	3
13	1	0	1	2	0	2	2	1	3	5	1	6
14	3	0	3	1	3	4	1	0	1	5	3	8
15	1	0	1	1	0	1	1	0	1	3	0	3
16	2	0	2	2	0	2	0	0	0	4	0	4
17	2	0	2	1	1	2	0	1	1	3	2	5
18	2	0	2	2	0	2	0	0	0	4	0	4
19	0	0	0	2	1	3	2	2	4	4	3	7
20	1	0	1	1	0	1	3	0	3	5	0	5
21	2	1	3	1	1	2	2	1	3	5	3	8
22	1	0	1	2	0	2	3	0	3	6	0	6
23	2	0	2	1	1	2	1	0	1	4	1	5
24	2	2	4	3	1	4	4	0	4	9	3	12
25	1	2	3	0	0	0	1	0	1	2	2	4
26	1	1	2	3	0	3	4	0	4	8	1	9
27	1	0	1	2	1	3	3	0	3	6	1	7
Total	41	11	52	38	14	52	45	6	51	124	31	155
Avg. cm^{-2} hr^{-1}	6.198	1.662	7.860	5.744	2.116	7.860	6.802	0.907	7.709	18.74	4.686	23.43

Daily average CFUs cm^{-2} hr^{-1} for October 15, 1999

	Filamentous CFUs	Yeast-like CFUs	Total CFUs
Average CFUs cm^{-2} hr^{-1}	6.248425	1.562106	7.810532

Appendix I.8

The following is a record of the raw data collected on **October 16**, 1999 in an aeromycological study performed at Mississippi Topsoils Inc. compost facility in Cold Spring, Minnesota during the period of October 9, 1999 to November 22, 1999. Colony forming units were counted on **3** plates using a grid marked with **27** boxes measuring **0.49** cm^2 each, with a total area measured of **13.23** cm^2 after being exposed for **0.5** hours. This record occurred **before** the compost facility began operation.

Samp. #	Plate 1			Plate 2			Plate 3			Sum Totals		
	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs
1	9	0	9	6	2	8	6	4	10	21	6	27
2	3	1	4	2	2	4	4	4	8	9	7	16
3	4	1	5	4	1	5	3	3	6	11	5	16
4	3	2	5	3	5	8	3	0	3	9	7	16
5	4	1	5	3	1	4	4	3	7	11	5	16
6	5	1	6	5	1	6	3	0	3	13	2	15
7	4	2	6	3	1	4	5	3	8	12	6	18
8	7	1	8	6	0	6	5	6	11	18	7	25
9	5	3	8	3	0	3	5	6	11	13	9	22
10	2	0	2	4	1	5	5	2	7	11	3	14
11	7	1	8	3	1	4	6	3	9	16	5	21
12	4	0	4	1	3	4	7	2	9	12	5	17
13	4	4	8	2	1	3	5	2	7	11	7	18
14	5	3	8	2	1	3	6	2	8	13	6	19
15	5	2	7	1	4	5	6	3	9	12	9	21
16	8	4	12	2	1	3	3	1	4	13	6	19
17	5	2	7	1	0	1	8	4	12	14	6	20
18	4	2	6	4	1	5	5	3	8	13	6	19
19	4	3	7	0	0	0	7	3	10	11	6	17
20	6	1	7	2	1	3	4	4	8	12	6	18
21	7	2	9	2	2	4	5	2	7	14	6	20
22	6	3	9	3	1	4	8	6	14	17	10	27
23	3	4	7	2	1	3	6	3	9	11	8	19
24	7	4	11	2	2	4	6	0	6	15	6	21
25	3	1	4	1	0	1	8	4	12	12	5	17
26	8	4	12	3	1	4	5	2	7	16	7	23
27	7	4	11	1	0	1	10	2	12	18	6	24
Total	139	56	195	71	34	105	148	77	225	358	167	525
Avg. cm^{-2} hr^{-1}	21.01	8.465	29.47	10.73	5.139	15.87	22.37	11.64	34.01	54.11	25.24	79.36

Daily average CFUs cm^{-2} hr^{-1} for October 16, 1999

	Filamentous CFUs	Yeast-like CFUs	Total CFUs
Average CFUs cm^{-2} hr^{-1}	18.03981	8.415218	26.45503

Appendix I.9

The following is a record of the raw data collected on **October 19**, 1999 in an aeromycological study performed at Mississippi Topsoils Inc. compost facility in Cold Spring, Minnesota during the period of October 9, 1999 to November 22, 1999. Colony forming units were counted on **3** plates with an area of **26.7** cm^2 each after being exposed for **0.5** hours. This record occurred **after** the compost facility began operation.

Samp. #	Plate 1			Plate 2			Plate 3			Sum Totals		
	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs
Total	59	81	140	68	84	152	55	47	102	182	212	394
Avg. cm^{-2} hr^{-1}	4.419	6.067	10.48	5.093	6.292	11.38	4.119	3.520	7.640	13.63	15.88	29.51

Daily average CFUs cm^{-2} hr^{-1} for October 19, 1999

	Filamentous CFUs	Yeast-like CFUs	Total CFUs
Average CFUs cm^{-2} hr^{-1}	4.54432	5.29338327	9.83770287

Appendix I.10

The following is a record of the raw data collected on **October 20**, 1999 in an aeromycological study performed at Mississippi Topsoils Inc. compost facility in Cold Spring, Minnesota during the period of October 9, 1999 to November 22, 1999. Colony forming units were counted on **3** plates with an area of **26.7** cm^2 each after being exposed for **0.5** hours. This record occurred **after** the compost facility began operation.

Samp. #	Plate 1			Plate 2			Plate 3			Sum Totals		
	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs
Total	60	104	164	76	89	165	60	99	159	196	292	488
Avg. cm^{-2} hr^{-1}	4.494	7.790	12.28	5.692	6.666	12.35	4.494	7.415	11.91	14.68	21.87	36.55

Daily average CFUs cm^{-2} hr^{-1} for October 20, 1999

	Filamentous CFUs	Yeast-like CFUs	Total CFUs
Average CFUs cm^{-2} hr^{-1}	4.89388	7.290886	12.184769

Appendix I.11

The following is a record of the raw data collected on **October 21**, 1999 in an aeromycological study performed at Mississippi Topsoils Inc. compost facility in Cold Spring, Minnesota during the period of October 9, 1999 to November 22, 1999. Colony forming units were counted on **3** plates with an area of **26.7** cm^2 each after being exposed for **0.5** hours. This record occurred **after** the compost facility began operation.

Samp. #	Plate 1			Plate 2			Plate 3			Sum Totals		
	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs
Total	76	114	190	80	117	197	71	93	164	227	324	551
Avg. cm^{-2} hr^{-1}	5.692	8.539	14.23	5.992	8.764	14.75	5.318	6.966	12.28	17.00	24.26	41.27

Daily average CFUs cm^{-2} hr^{-1} for October 21, 1999

	Filamentous CFUs	Yeast-like CFUs	Total CFUs
Average CFUs cm^{-2} hr^{-1}	5.66792	8.089888	13.757803

Appendix I.12

The following is a record of the raw data collected on **October 22**, 1999 in an aeromycological study performed at Mississippi Topsoils Inc. compost facility in Cold Spring, Minnesota during the period of October 9, 1999 to November 22, 1999. Colony forming units were counted on **2** plates using a grid marked with **27** boxes measuring **0.49** cm^2 each, with a total area measured of **13.23** cm^2 after being exposed for **0.5** hours. This record occurred **after** the compost facility began operation.

Samp. #	Plate 1			Plate 2			Sum Totals		
	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs
1	7	4	11	12	5	17	19	9	28
2	12	6	18	5	5	10	17	11	28
3	8	10	18	7	2	9	15	12	27
4	10	6	16	5	4	9	15	10	25
5	8	5	13	10	5	15	18	10	28
6	9	10	19	5	5	10	14	15	29
7	11	8	19	9	5	14	20	13	33
8	7	4	11	6	4	10	13	8	21
9	10	6	16	6	7	13	16	13	29
10	7	6	13	4	2	6	11	8	19
11	9	8	17	9	6	15	18	14	32
12	8	6	14	6	5	11	14	11	25
13	3	6	9	5	1	6	8	7	15
14	6	7	13	6	4	10	12	11	23
15	5	8	13	4	3	7	9	11	20
16	8	9	17	5	6	11	13	15	28
17	7	5	12	3	4	7	10	9	19
18	5	4	9	8	3	11	13	7	20
19	6	4	10	3	6	9	9	10	19
20	9	5	14	5	7	12	14	12	26
21	5	4	9	6	3	9	11	7	18
22	9	4	13	4	4	8	13	8	21
23	4	5	9	8	1	9	12	6	18
24	6	7	13	2	2	4	8	9	17
25	5	6	11	7	3	10	12	9	21
26	9	4	13	7	3	10	16	7	23
27	8	3	11	5	6	11	13	9	22
Total	201	160	361	162	111	273	363	271	634
Avg. cm^{-2} hr^{-1}	30.38	24.18	54.57	24.48	16.78	41.26	54.87	40.96	95.84

Daily average CFUs cm^{-2} hr^{-1} for October 22, 1999

	Filamentous CFUs	Yeast-like CFUs	Total CFUs
Average CFUs cm^{-2} hr^{-1}	27.4376	20.48374906	47.92139

Appendix I.13

The following is a record of the raw data collected on **October 23**, 1999 in an aeromycological study performed at Mississippi Topsoils Inc. compost facility in Cold Spring, Minnesota during the period of October 9, 1999 to November 22, 1999. Colony forming units were counted on **3** plates with an area of **26.7** cm^2 each after being exposed for **0.5** hours. This record occurred **after** the compost facility began operation.

Samp. #	Plate 1			Plate 2			Plate 3			Sum Totals		
	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs
Total	6	32	38	10	17	27	9	10	19	25	59	84
Avg. cm^{-2} hr^{-1}	0.449	2.397	2.846	0.749	1.273	2.022	0.674	0.749	1.423	1.872	4.419	6.292

Daily average CFUs cm^{-2} hr^{-1} for October 23, 1999

	Filamentous CFUs	Yeast-like CFUs	Total CFUs
Average CFUs cm^{-2} hr^{-1}	0.62422	1.473159	2.0973783

Appendix I.14

The following is a record of the raw data collected on **October 25**, 1999 in an aeromycological study performed at Mississippi Topsoils Inc. compost facility in Cold Spring, Minnesota during the period of October 9, 1999 to November 22, 1999. Colony forming units were counted on **2** plates using a grid marked with **27** boxes measuring **0.49** cm^2 each, with a total area measured of **13.23** cm^2 after being exposed for **0.5** hours. This record occurred **after** the compost facility began operation.

Samp. #	Plate 1			Plate 2			Sum Totals		
	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs
1	3	13	16	1	10	11	4	23	27
2	2	21	23	4	15	19	6	36	42
3	3	16	19	4	15	19	7	31	38
4	2	15	17	3	15	18	5	30	35
5	4	13	17	3	15	18	7	28	35
6	5	15	20	3	18	21	8	33	41
7	3	8	11	5	12	17	8	20	28
8	3	18	21	4	8	12	7	26	33
9	3	13	16	3	14	17	6	27	33
10	3	7	10	4	16	20	7	23	30
11	3	23	26	3	15	18	6	38	44
12	3	11	14	4	11	15	7	22	29
13	4	18	22	3	12	15	7	30	37
14	3	10	13	4	16	20	7	26	33
15	3	17	20	4	11	15	7	28	35
16	1	15	16	4	11	15	5	26	31
17	1	14	15	2	16	18	3	30	33
18	2	14	16	3	14	17	5	28	33
19	3	18	21	1	14	15	4	32	36
20	2	16	18	2	16	18	4	32	36
21	2	12	14	6	15	21	8	27	35
22	3	15	18	3	19	22	6	34	40
23	3	19	22	3	16	19	6	35	41
24	2	26	28	0	9	9	2	35	37
25	3	23	26	3	19	22	6	42	48
26	3	18	21	2	15	17	5	33	38
27	3	18	21	1	18	19	4	36	40
Total	75	426	501	82	385	467	157	811	968
Avg. cm^{-2} hr^{-1}	11.33	64.39	75.73	12.39	58.20	70.59	23.73	122.6	146.3

Daily average CFUs cm^{-2} hr^{-1} for October 25, 1999

	Filamentous CFUs	Yeast-like CFUs	Total CFUs
Average CFUs cm^{-2} hr^{-1}	11.86696901	61.30008	73.167045

Appendix I.15

The following is a record of the raw data collected on **October 26**, 1999 in an aeromycological study performed at Mississippi Topsoils Inc. compost facility in Cold Spring, Minnesota during the period of October 9, 1999 to November 22, 1999. Colony forming units were counted on **3** plates with an area of **26.7** cm^2 each after being exposed for **0.5** hours. This record occurred **after** the compost facility began operation.

Samp. #	Plate 1			Plate 2			Plate 3			Sum Totals		
	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs
Total	65	28	93	78	32	110	53	38	91	196	98	294
Avg. cm^{-2} hr^{-1}	4.868	2.097	6.966	5.842	2.397	8.239	3.970	2.846	6.816	14.68	7.340	22.02

Daily average CFUs cm^{-2} hr^{-1} for October 26, 1999

	Filamentous CFUs	Yeast-like CFUs	Total CFUs
Average CFUs cm^{-2} hr^{-1}	4.89388	2.446941	7.340824

Appendix I.16

The following is a record of the raw data collected on **October 27**, 1999 in an aeromycological study performed at Mississippi Topsoils Inc. compost facility in Cold Spring, Minnesota during the period of October 9, 1999 to November 22, 1999. Colony forming units were counted on **3** plates with an area of **26.7** cm^2 each after being exposed for **0.5** hours. This record occurred **after** the compost facility began operation.

Samp. #	Plate 1			Plate 2			Plate 3			Sum Totals		
	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs
Total	77	65	142	76	76	152	59	58	117	212	199	411
Avg. cm^{-2} hr^{-1}	5.767	4.868	10.63	5.692	5.692	11.38	4.419	4.344	8.764	15.88	14.90	30.78

Daily average CFUs cm^{-2} hr^{-1} for October 27, 1999

	Filamentous CFUs	Yeast-like CFUs	Total CFUs
Average CFUs cm^{-2} hr^{-1}	5.29338	4.968789	10.262172

Appendix I.17

The following is a record of the raw data collected on **October 28**, 1999 in an aeromycological study performed at Mississippi Topsoils Inc. compost facility in Cold Spring, Minnesota during the period of October 9, 1999 to November 22, 1999. Colony forming units were counted on **3** plates with an area of **26.7** cm^2 each after being exposed for **0.5** hours. This record occurred **after** the compost facility began operation.

Samp. #	Plate 1			Plate 2			Plate 3			Sum Totals		
	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs
Total	34	57	91	41	87	128	36	67	103	111	211	322
Avg. cm^{-2} hr^{-1}	2.546	4.269	6.816	3.071	6.516	9.588	2.696	5.018	7.715	8.314	15.80	24.11

Daily average CFUs cm^{-2} hr^{-1} for October 28, 1999

	Filamentous CFUs	Yeast-like CFUs	Total CFUs
Average CFUs cm^{-2} hr^{-1}	**2.77154**	**5.268414**	**8.0399501**

Appendix I.18

The following is a record of the raw data collected on **October 29**, 1999 in an aeromycological study performed at Mississippi Topsoils Inc. compost facility in Cold Spring, Minnesota during the period of October 9, 1999 to November 22, 1999. Colony forming units were counted on **3** plates with an area of **26.7** cm^2 each after being exposed for **0.5** hours. This record occurred **after** the compost facility began operation.

Samp. #	Plate 1			Plate 2			Plate 3			Sum Totals		
	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs
Total	86	34	120	94	21	115	111	43	154	291	98	389
Avg. cm^{-2} hr^{-1}	6.441	2.546	8.988	7.041	1.573	8.614	8.314	3.220	11.53	21.79	7.340	29.13

Daily average CFUs cm^{-2} hr^{-1} for October 29, 1999

	Filamentous CFUs	Yeast-like CFUs	Total CFUs
Average CFUs cm^{-2} hr^{-1}	7.26592	2.446941	9.7128589

Appendix I.19

The following is a record of the raw data collected on **October 30**, 1999 in an aeromycological study performed at Mississippi Topsoils Inc. compost facility in Cold Spring, Minnesota during the period of October 9, 1999 to November 22, 1999. Colony forming units were counted on **3** plates with an area of **26.7** cm^2 each after being exposed for **0.5** hours. This record occurred **after** the compost facility began operation.

Samp. #	Plate 1			Plate 2			Plate 3			Sum Totals		
	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs
Total	41	28	69	43	11	54	39	13	52	123	52	175
Avg. cm^{-2} hr^{-1}	3.071	2.097	5.168	3.220	0.823	4.044	2.921	0.973	3.895	9.213	3.895	13.10

Daily average CFUs cm^{-2} hr^{-1} for October 30, 1999

	Filamentous CFUs	Yeast-like CFUs	Total CFUs
Average CFUs cm^{-2} hr^{-1}	**3.07116**	**1.298377**	**4.3695381**

Appendix I.20

The following is a record of the raw data collected on **November 1**, 1999 in an aeromycological study performed at Mississippi Topsoils Inc. compost facility in Cold Spring, Minnesota during the period of October 9, 1999 to November 22, 1999. Colony forming units were counted on **3** plates using a grid marked with **27** boxes measuring **0.49** cm^2 each, with a total area measured of **13.23** cm^2 after being exposed for **0.5** hours. This record occurred **before** the compost facility began operation.

Samp. #	Plate 1			Plate 2			Plate 3			Sum Totals		
	F. CFUs	Y CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs
1	5	6	11	6	8	14	7	8	15	18	22	40
2	6	4	10	3	6	9	4	5	9	13	15	28
3	6	3	9	8	14	22	3	4	7	17	21	38
4	10	6	16	12	8	20	6	4	10	28	18	46
5	6	13	19	8	8	16	4	3	7	18	24	42
6	8	2	10	9	7	16	2	7	9	19	16	35
7	5	9	14	5	8	13	4	4	8	14	21	35
8	5	4	9	2	6	8	4	5	9	11	15	26
9	5	6	11	8	6	14	6	6	12	19	18	37
10	10	4	14	6	9	15	3	6	9	19	19	38
11	3	3	6	7	8	15	2	4	6	12	15	27
12	5	5	10	8	9	17	5	3	8	18	17	35
13	3	5	8	6	10	16	3	4	7	12	19	31
14	6	3	9	8	9	17	1	6	7	15	18	33
15	8	2	10	1	7	8	4	4	8	13	13	26
16	7	5	12	1	10	11	7	2	9	15	17	32
17	10	7	17	10	4	14	4	4	8	24	15	39
18	6	7	13	10	6	16	3	5	8	19	18	37
19	8	3	11	7	4	11	3	6	9	18	13	31
20	9	4	13	4	6	10	4	4	8	17	14	31
21	8	4	12	7	4	11	4	3	7	19	11	30
22	8	4	12	7	4	11	4	4	8	19	12	31
23	5	8	13	7	6	13	6	8	14	18	22	40
24	11	8	19	2	4	6	2	3	5	15	15	30
25	6	7	13	6	6	12	4	5	9	16	18	34
26	9	9	18	2	5	7	3	4	7	14	18	32
27	6	8	14	5	6	11	2	3	5	13	17	30
Total	184	149	333	165	188	353	104	124	228	453	461	914
Avg. cm^{-2} hr^{-1}	27.81	22.52	50.34	24.94	28.42	53.36	15.72	18.74	34.46	68.48	69.69	138.1

Daily average CFUs cm^{-2} hr^{-1} for November 1, 1999

	Filamentous CFUs	Yeast-like CFUs	Total CFUs
Average CFUs cm^{-2} hr^{-1}	22.8269	23.23	46.0569

Appendix I.21

The following is a record of the raw data collected on **November 2**, 1999 in an aeromycological study performed at Mississippi Topsoils Inc. compost facility in Cold Spring, Minnesota during the period of October 9, 1999 to November 22, 1999. Colony forming units were counted on **3** plates with an area of **26.7** cm^2 each after being exposed for **0.5** hours. This record occurred **after** the compost facility began operation.

Samp. #	Plate 1			Plate 2			Plate 3			Sum Totals		
	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs
Total	28	57	85	36	39	75	44	57	101	108	153	261
Avg. cm^{-2} hr^{-1}	2.097	4.269	6.367	2.696	2.921	5.617	3.295	4.269	7.565	8.089	11.46	19.55

Daily average CFUs cm^{-2} hr^{-1} for November 2, 1999

	Filamentous CFUs	Yeast-like CFUs	Total CFUs
Average CFUs cm^{-2} hr^{-1}	2.69663	3.820225	6.5168539

Appendix I.22

The following is a record of the raw data collected on **November 3**, 1999 in an aeromycological study performed at Mississippi Topsoils Inc. compost facility in Cold Spring, Minnesota during the period of October 9, 1999 to November 22, 1999. Colony forming units were counted on **3** plates with an area of **26.7** cm^2 each after being exposed for **0.5** hours. This record occurred **after** the compost facility began operation.

Samp. #	Plate 1			Plate 2			Plate 3			Sum Totals		
	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs
Total	57	31	88	62	23	85	55	31	86	174	85	259
Avg. cm^{-2} hr^{-1}	4.269	2.322	6.591	4.644	1.722	6.367	4.119	2.322	6.441	13.03	6.367	19.40

Daily average CFUs cm^{-2} hr^{-1} for November 3, 1999

	Filamentous CFUs	Yeast-like CFUs	Total CFUs
Average CFUs cm^{-2} hr^{-1}	4.34457	2.122347	6.4669164

Appendix I.23

The following is a record of the raw data collected on **November 4**, 1999 in an aeromycological study performed at Mississippi Topsoils Inc. compost facility in Cold Spring, Minnesota during the period of October 9, 1999 to November 22, 1999. Colony forming units were counted on **3** plates with an area of **26.7** cm^2 each after being exposed for **0.5** hours. This record occurred **after** the compost facility began operation.

Samp. #	Plate 1			Plate 2			Plate 3			Sum Totals		
	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs
Total	83	18	101	80	24	104	52	37	89	215	79	294
Avg. cm^{-2} hr^{-1}	6.217	1.348	7.565	5.992	1.797	7.790	3.895	2.771	6.666	16.10	5.917	22.02

Daily average CFUs cm^{-2} hr^{-1} for November 4, 1999

	Filamentous CFUs	Yeast-like CFUs	Total CFUs
Average CFUs cm^{-2} hr^{-1}	5.36829	1.972534	7.340824

Appendix I.24

The following is a record of the raw data collected on **November 5**, 1999 in an aeromycological study performed at Mississippi Topsoils Inc. compost facility in Cold Spring, Minnesota during the period of October 9, 1999 to November 22, 1999. Colony forming units were counted on **3** plates with an area of **26.7** cm^2 each after being exposed for **0.5** hours. This record occurred **after** the compost facility began operation.

Samp. #	Plate 1			Plate 2			Plate 3			Sum Totals		
	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs
Total	56	135	191	50	63	113	39	67	106	145	265	410
Avg. cm^{-2} hr^{-1}	4.194	10.11	14.30	3.745	4.719	8.464	2.921	5.018	7.940	10.86	19.85	30.71

Daily average CFUs cm^{-2} hr^{-1} for November 5, 1999

	Filamentous CFUs	Yeast-like CFUs	Total CFUs
Average CFUs cm^{-2} hr^{-1}	3.62047	6.616729	10.237203

Appendix I.25

The following is a record of the raw data collected on **November 6**, 1999 in an aeromycological study performed at Mississippi Topsoils Inc. compost facility in Cold Spring, Minnesota during the period of October 9, 1999 to November 22, 1999. Colony forming units were counted on **3** plates with an area of **26.7** cm^2 each after being exposed for **0.5** hours. This record occurred **after** the compost facility began operation.

Samp. #	Plate 1			Plate 2			Plate 3			Sum Totals		
	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs
Total	10	2	12	10	5	15	9	3	12	29	10	39
Avg. cm^{-2} hr^{-1}	0.749	0.149	0.898	0.749	0.374	1.123	0.674	0.224	0.898	2.172	0.749	2.921

Daily average CFUs cm^{-2} hr^{-1} for November 6, 1999

	Filamentous CFUs	Yeast-like CFUs	Total CFUs
Average CFUs cm^{-2} hr^{-1}	0.72409	0.249688	0.9737828

Appendix I.26

The following is a record of the raw data collected on **November 8**, 1999 in an aeromycological study performed at Mississippi Topsoils Inc. compost facility in Cold Spring, Minnesota during the period of October 9, 1999 to November 22, 1999. Colony forming units were counted on **3** plates with an area of **26.7** cm^2 each after being exposed for **0.5** hours. This record occurred **after** the compost facility began operation.

Samp. #	Plate 1			Plate 2			Plate 3			Sum Totals		
	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs
Total	99	36	135	54	117	171	78	113	191	231	266	497
Avg. cm^{-2} hr^{-1}	7.415	2.696	10.11	4.044	8.764	12.80	5.842	8.464	14.30	17.30	19.92	37.22

Daily average CFUs cm^{-2} hr^{-1} for November 8, 1999

	Filamentous CFUs	Yeast-like CFUs	Total CFUs
Average CFUs cm^{-2} hr^{-1}	5.76779	6.641698	12.409488

Appendix I.27

The following is a record of the raw data collected on **November 9**, 1999 in an aeromycological study performed at Mississippi Topsoils Inc. compost facility in Cold Spring, Minnesota during the period of October 9, 1999 to November 22, 1999. Colony forming units were counted on **3** plates with an area of **26.7** cm^2 each after being exposed for **0.5** hours. This record occurred **after** the compost facility began operation.

Samp. #	Plate 1			Plate 2			Plate 3			Sum Totals		
	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs
Total	17	11	28	24	30	54	20	29	49	61	70	131
Avg. cm^{-2} hr^{-1}	1.273	0.823	2.097	1.797	2.247	4.044	1.498	2.172	3.670	4.569	5.243	9.812

Daily average CFUs cm^{-2} hr^{-1} for November 9, 1999

	Filamentous CFUs	Yeast-like CFUs	Total CFUs
Average CFUs cm^{-2} hr^{-1}	**1.5231**	**1.747815**	**3.2709114**

Appendix I.28

The following is a record of the raw data collected on **November 10**, 1999 in an aeromycological study performed at Mississippi Topsoils Inc. compost facility in Cold Spring, Minnesota during the period of October 9, 1999 to November 22, 1999. Colony forming units were counted on **3** plates with an area of **26.7** cm^2 each after being exposed for **0.5** hours. This record occurred **after** the compost facility began operation.

Samp. #	Plate 1			Plate 2			Plate 3			Sum Totals		
	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs
Total	23	40	63	29	13	42	17	8	25	69	61	130
Avg. cm^{-2} hr^{-1}	1.722	2.996	4.719	2.172	0.973	3.146	1.273	0.599	1.872	5.168	4.569	9.737

Daily average CFUs cm^{-2} hr^{-1} for November 10, 1999

	Filamentous CFUs	Yeast-like CFUs	Total CFUs
Average CFUs cm^{-2} hr^{-1}	1.72285	1.523096	3.2459426

Appendix I.29

The following is a record of the raw data collected on **November 11**, 1999 in an aeromycological study performed at Mississippi Topsoils Inc. compost facility in Cold Spring, Minnesota during the period of October 9, 1999 to November 22, 1999. Colony forming units were counted on **3** plates with an area of **26.7** cm^2 each after being exposed for **0.5** hours. This record occurred **after** the compost facility began operation.

Samp. #	Plate 1			Plate 2			Plate 3			Sum Totals		
	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs
Total	30	18	48	37	15	52	39	19	58	106	52	158
Avg. cm^{-2} hr^{-1}	2.247	1.348	3.595	2.771	1.123	3.895	2.921	1.423	4.344	7.940	3.895	11.83

Daily average CFUs cm^{-2} hr^{-1} for November 11, 1999

	Filamentous CFUs	Yeast-like CFUs	Total CFUs
Average CFUs cm^{-2} hr^{-1}	2.64669	1.298377	3.9450687

Appendix I.30

The following is a record of the raw data collected on **November 12**, 1999 in an aeromycological study performed at Mississippi Topsoils Inc. compost facility in Cold Spring, Minnesota during the period of October 9, 1999 to November 22, 1999. Colony forming units were counted on **3** plates with an area of **26.7** cm^2 each after being exposed for **0.5** hours. This record occurred **after** the compost facility began operation.

Samp. #	Plate 1			Plate 2			Plate 3			Sum Totals		
	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs
Total	27	19	46	32	20	52	34	11	45	93	50	143
Avg. cm^{-2} hr^{-1}	2.022	1.423	3.445	2.397	1.498	3.895	2.54	0.823	3.370	6.966	3.745	10.71

Daily average CFUs cm^{-2} hr^{-1} for November 12, 1999

	Filamentous CFUs	Yeast-like CFUs	Total CFUs
Average CFUs cm^{-2} hr^{-1}	2.3221	1.248439	3.5705368

Appendix I.31

The following is a record of the raw data collected on **November 15**, 1999 in an aeromycological study performed at Mississippi Topsoils Inc. compost facility in Cold Spring, Minnesota during the period of October 9, 1999 to November 22, 1999. Colony forming units were counted on **3** plates with an area of **26.7** cm^2 each after being exposed for **0.5** hours. This record occurred **after** the compost facility began operation.

Samp. #	Plate 1			Plate 2			Plate 3			Sum Totals		
	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs
Total	20	15	35	15	22	37	20	18	38	55	55	110
Avg. cm^{-2} hr^{-1}	1.498	1.123	2.621	1.123	1.647	2.771	1.498	1.348	2.846	4.119	4.119	8.239

Daily average CFUs cm^{-2} hr^{-1} for November 15, 1999

	Filamentous CFUs	Yeast-like CFUs	Total CFUs
Average CFUs cm^{-2} hr^{-1}	1.37328	1.373283	2.7465668

Appendix I.32

The following is a record of the raw data collected on **November 16**, 1999 in an aeromycological study performed at Mississippi Topsoils Inc. compost facility in Cold Spring, Minnesota during the period of October 9, 1999 to November 22, 1999. Colony forming units were counted on **3** plates with an area of **26.7** cm^2 each after being exposed for **0.5** hours. This record occurred **after** the compost facility began operation.

Samp. #	Plate 1			Plate 2			Plate 3			Sum Totals		
	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs
Total	30	11	41	31	16	47	35	30	65	96	57	153
Avg. cm^{-2} hr^{-1}	2.247	0.823	3.071	2.322	1.198	3.520	2.621	2.247	4.868	7.191	4.269	11.46

Daily average CFUs cm^{-2} hr^{-1} for November 16, 1999

	Filamentous CFUs	Yeast-like CFUs	Total CFUs
Average CFUs cm^{-2} hr^{-1}	2.397	1.423221	3.8202247

Appendix I.33

The following is a record of the raw data collected on **November 17**, 1999 in an aeromycological study performed at Mississippi Topsoils Inc. compost facility in Cold Spring, Minnesota during the period of October 9, 1999 to November 22, 1999. Colony forming units were counted on **3** plates with an area of **26.7** cm^2 each after being exposed for **0.5** hours. This record occurred **after** the compost facility began operation.

Samp. #	Plate 1			Plate 2			Plate 3			Sum Totals		
	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs
Total	88	22	110	81	19	100	74	22	96	243	63	306
Avg. cm^{-2} hr^{-1}	6.591	1.647	8.239	6.067	1.423	7.490	5.543	1.647	7.191	18.20	4.719	22.92

Daily average CFUs cm^{-2} hr^{-1} for November 17, 1999

	Filamentous CFUs	Yeast-like CFUs	Total CFUs
Average CFUs cm^{-2} hr^{-1}	6.06742	1.573034	7.6404494

Appendix I.34

The following is a record of the raw data collected on **November 18**, 1999 in an aeromycological study performed at Mississippi Topsoils Inc. compost facility in Cold Spring, Minnesota during the period of October 9, 1999 to November 22, 1999. Colony forming units were counted on **3** plates with an area of **26.7** cm^2 each after being exposed for **0.5** hours. This record occurred **after** the compost facility began operation.

Samp. #	Plate 1			Plate 2			Plate 3			Sum Totals		
	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs
Total	71	21	92	60	29	89	68	48	116	199	98	297
Avg. cm^{-2} hr^{-1}	5.318	1.573	6.891	4.494	2.172	6.666	5.093	3.595	8.689	14.90	7.340	22.24

Daily average CFUs cm^{-2} hr^{-1} for November 18, 1999

	Filamentous CFUs	Yeast-like CFUs	Total CFUs
Average CFUs cm^{-2} hr^{-1}	4.96879	2.446941	7.4157303

Appendix I.35

The following is a record of the raw data collected on **November 19**, 1999 in an aeromycological study performed at Mississippi Topsoils Inc. compost facility in Cold Spring, Minnesota during the period of October 9, 1999 to November 22, 1999. Colony forming units were counted on **3** plates with an area of **26.7** cm^2 each after being exposed for **0.5** hours. This record occurred **after** the compost facility began operation.

Samp. #	Plate 1			Plate 2			Plate 3			Sum Totals		
	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs
Total	6	3	9	10	5	15	21	5	26	37	13	50
Avg. cm^{-2} hr^{-1}	0.449	0.224	0.674	0.749	0.374	1.123	1.573	0.374	1.947	2.771	0.973	3.745

Daily average CFUs cm^{-2} hr^{-1} for November 19, 1999

	Filamentous CFUs	Yeast-like CFUs	Total CFUs
Average CFUs cm^{-2} hr^{-1}	0.92385	0.324594	1.2484395

Appendix I.36

The following is a record of the raw data collected on **November 2**, 1999 in an aeromycological study performed at Mississippi Topsoils Inc. compost facility in Cold Spring, Minnesota during the period of October 9, 1999 to November 22, 1999. Colony forming units were counted on **3** plates with an area of **26.7** cm^2 each after being exposed for **0.5** hours. This record occurred **after** the compost facility began operation.

Samp. #	Plate 1			Plate 2			Plate 3			Sum Totals		
	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs	F. CFUs	Y. CFUs	T. CFUs
Total	3	2	5	5	2	7	6	2	8	14	6	20
Avg. cm^{-2} hr^{-1}	0.224	0.149	0.374	0.374	0.149	0.524	0.449	0.149	0.599	1.048	0.449	1.498

Daily average CFUs cm^{-2} hr^{-1} for November 22, 1999

	Filamentous CFUs	Yeast-like CFUs	Total CFUs
Average CFUs cm^{-2} hr^{-1}	0.34956	0.149813	0.4993758

Appendix II

The following is a record of climatic data –average temperature (deg. F), average wind speed (mph), precipitation (inches)- collected by the St. Cloud National Weather Service in Minnesota from October 1, 1999 to November 22, 1999. The average over the time period studied has been calculated and the slope of the trendline for the data over the time period has been calculated. The data was downloaded from the University of Minnesota Climatology Working Group's Internet site (http://climate.umn.edu/).

Date	Average Temperature (deg. F)	Average Wind Speed (mph)	Precipitation (inches)
10/1	39	8.10	0.01
10/2	37	7.20	0.00
10/3	37	3.80	0.00
10/4	46	8.00	0.00
10/5	43	6.20	0.00
10/6	40	8.70	0.01
10/7	62	8.70	0.44
10/8	56	7.10	0.01
10/9	58	9.00	0.00
10/10	51	7.30	0.00
10/11	48	6.30	0.00
10/12	53	7.80	0.01
10/13	47	7.40	0.00
10/14	56	10.00	0.00
10/15	53	7.30	0.00
10/16	44	NDR*	0.00
10/17	38	6.20	0.00
10/18	40	6.40	0.01
10/19	36	10.00	0.00
10/20	38	8.30	0.00
10/21	52	14.20	0.00
10/22	41	15.70	0.00
10/23	35	7.30	0.00
10/24	38	7.60	0.00
10/25	48	11.80	0.00
10/26	43	4.30	0.00
10/27	52	10.80	0.00
10/28	40	6.40	0.00
10/29	49	6.70	0.78
10/30	50	7.90	0.12
10/31	50	8.00	0.00
11/1	45	20.70	0.01
11/2	33	8.20	0.00
11/3	34	2.70	0.00
11/4	37	7.10	0.00

11/5	38	9.80	0.00
11/6	37	6.00	0.00
11/7	47	8.30	0.00
11/8	56	9.20	0.00
11/9	52	3.80	0.00
11/10	45	11.60	0.01
11/11	38	8.70	0.00
11/12	41	3.50	0.00
11/13	54	12.10	0.00
11/14	35	7.70	0.00
11/15	37	3.70	0.00
11/16	34	3.00	0.00
11/17	39	8.10	0.00
11/18	42	11.20	0.00
11/19	33	12.50	0.01
11/20	30	7.00	0.00
11/21	40	6.00	0.09
11/22	37	6.70	0.00
Average	**43.47**	**8.12**	**0.03**
Slope	**-0.175**	**-0.001**	**N/A**

*NDR: No data reported